PB85-112209

Environmental Progress and Challenges: An EPA (Environmental Protection Agency) Perspective

(U.S.) Environmental Protection Agency
Washington, DC

Jun 84

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO. PB85 112209
4. TITLE AND SUBTITLE ENVIRONMENTAL PROGRESS AND CHALLENGES: AN EPA PERSPECTIVE		5. REPORT DATE June 1984
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Lewis S. W. Crampton, Cynthia C. Kelly, Sherron L. Hiemstra		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Same as box 12.		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Management Systems and Evaluation Environmental Results Branch U.S. Environmental Protection Agency Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE EPA 300/04

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report presents the Environmental Protection Agency's (EPA's) assessment of the progress we have made as a Nation in improving the quality of the air we breathe, the water we depend on, and the land where we live. More importantly, it presents EPA's agenda for restoring and protecting these resources from past and future environmental hazards.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

18. DISTRIBUTION STATEMENT NTIS, Springfield, VA 22161	19. SECURITY CLASS *(This Report)* UNCLASSIFIED	21. NO. OF PAGES 125
	20. SECURITY CLASS *(This page)* UNCLASSIFIED	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

ENVIRONMENTAL PROGRESS AND CHALLENGES:
AN EPA PERSPECTIVE

United States Environmental Protection Agency

William D. Ruckelshaus
Administrator

Alvin L. Alm
Deputy Administrator

Milton Russell
Assistant Administrator for Policy, Planning, and Evaluation

Josephine S. Cooper
Assistant Administrator for External Affairs

Ronald Brand
Director, Office of Management Systems and Evaluation

June 1984

COLOR ILLUSTRATIONS REPRODUCED
IN BLACK AND WHITE

DEDICATION TO DR. TIMOTHY A. MATZKE

All of us in the Environmental Protection Agency (EPA) owe an immeasurable debt of gratitude to Dr. Timothy A. Matzke. In addition to contributing to this report, Tim provided leadership in strengthening the Nation's environmental monitoring programs until his untimely death on August 24, 1984. Throughout his decade–long career with EPA, Tim's vision and dedication were instrumental in improving our ability to meet the environmental challenges described in this report. As a small token of our esteem, we dedicate this report to his memory.

ACKNOWLEDGEMENTS

This report was prepared by the Environmental Results Branch of the Management Systems Division, Office of Management Systems and Evaluation of the Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, under the leadership of Lewis S.W. Crampton, Director, OMSE; Cynthia C. Kelly, Director, Management Systems Division; and Sherron L. Hiemstra, Chief, Environmental Results Branch.

Within the Environmental Results Branch, many persons contributed their time, energy, and support to developing the report. We would particularly like to recognize the following individuals:

Robert W. Barles, Project Manager;

Charles A. Parker, John W. Wilson, William V. Garetz, and Michael T. Grepo, who researched and wrote major sections of the report;

Sandra D. Oden, Charles E. Roark, Geraldine Schweitzer, and Deloise Brooks, who typed and distributed many drafts and revisions of the material within extremely short time frames;

Constance L. Tasker and David F. Hamnett, who edited the report and researched and wrote many of the highlights in the report.

Many persons outside the Office of Management Systems and Evaluation also made very important contributions to the report. Although it would be impossible to fully acknowledge all those individuals and their contributions, some of the persons who deserve special thanks are:

Donald Bliss of EPA Region 10, who spent weeks in Washington editing numerous drafts of the report and significantly improving it in the process;

Diane Smirnow, who was the graphic designer;

Dave Berg, Greg Dana, Greg Glahn, Bill Hunt, and Fred Renner, who reviewed and contributed to the Air section of the report;

Fred Leutner, Bob Linett, Marian Mlay, Sally Neuber, Steven Schatzow, Suzanne Schwartz, and Rita Smith, who reviewed and contributed to the Water section of the report;

Bonnie Casper and Dana Rodgers, who reviewed and contributed to the Land section of the report;

Norm Chlosta, Bob Janney, Casey Jason, Walt Kovalick, and Marylouise Uhlig who reviewed and contributed to the Toxic Chemicals section of the report;

Paul Ciriello, Jim Finger, Dave Hill, and Bill Sanders, who provided many of the highlights used in the report as well as serving as very active and diligent members of the Advisory committee;

Amy Marasco, Clem Rastatter, and Claire Gesalman, of the Synectics Group (TSG), who helped develop the concept of the report;

Robert Flanagan, who provided typesetting for the text and Litho Composition Services, Inc., who typeset the charts and graphics;

Steve Delaney, Joe Sabbagh, M.E. Warren and the U.S. National Archives who provided the photography;

Angela Bradley, who assisted with the graphic production, Marilyn Kaufman, who illustrated some of the graphics, and Bobbi Tull, who did the cover illustration.

CONTENTS

1 Preface

3 **ADMINISTRATOR'S OVERVIEW**

11 **AIR**
12 An Overview
18 Ozone
22 Airborne Particulates
24 Carbon Monoxide
26 Sulfur Dioxide
28 Airborne Lead
30 Airborne Toxics
34 Acid Deposition

41 **WATER**
42 An Overview
48 Ground-Water Protection
52 Toxics Pollution
56 Drinking Water
60 Wetlands
62 Pollution from Sewage
66 Nonpoint Source Pollution

71 **LAND**
72 An Overview
78 Uncontrolled Hazardous Site Cleanup
82 Newly Generated Hazardous Waste Control
86 Radioactive Waste Disposal
88 Municipal Sludge

93 **TOXIC CHEMICALS**
94 An Overview
102 Pesticides
108 Dioxin
110 Asbestos
114 PCBs (Polychlorinated Biphenyls)

PREFACE

This report presents the Environmental Protection Agency's (EPA's) assessment of the progress we have made as a Nation in improving the quality of the air we breathe, the water we depend on, and the land where we live. More importantly, it presents EPA's agenda for restoring and protecting these resources from past and future environmental hazards.

In large part, this report is based on "Environmental Management Reports" (EMRs) prepared for the first time last year by each of EPA's ten Regional offices. Drawing from the EMRs, the report presents the progress we have made and problems that remain in each environmental medium—air, water, and land—and for controlling the risks of pesticides and toxic substances. In addition, we have selected 22 issues for more detailed discussion.

Virtually every office in EPA contributed to this report. Prepared by the Office of Management Systems and Evaluation, drafts have been extensively reviewed by members of an Advisory Review Panel and contacts throughout EPA Headquarters and Regional offices. We gratefully appreciate the valuable contributions that our colleagues throughout EPA have made in formulating and critiquing this report. In particular, we want to acknowledge the extraordinary work of EPA Regional staff who produced the Environmental Management Reports. The EMRs have not only made a national environmental report possible but have provided a unique basis for managing our programs to achieve the greatest environmental benefits in years ahead.

ADMINISTRATOR'S OVERVIEW

When I became the first Administrator of the Environmental Protection Agency in 1970, the Nation was suffering from many years of environmental neglect. We not only read about it and saw its effects reported on television but experienced it personally in our daily lives.

Although cities, States, and the Federal Government were attempting to halt the spread of pollution and to protect public health, their efforts were having limited success. Raw sewage and industrial waste were being discharged into our waters, forcing many rivers, lakes, and beaches to be closed to swimming and boating and to be unusable as sources of drinking water. Some waters were so fouled that they occasionally caught fire. Warnings not to eat fish caught in certain waters were common, and some fish populations were disappearing completely.

Air pollution from cars and industries was also an increasingly serious problem. The elderly, children, and others vulnerable to air pollution were regularly cautioned not to venture outdoors on certain days, and some persons were even hospitalized. Many cities were blanketed in smoke and fumes that blocked the sky, caused eye irritation, and smelled so offensive that complaints were commonplace.

Finally, the land was being used indiscriminately as a dumping ground for the wastes of our growing industrial and technological society.

The major force that brought a halt to this destructive spiral was public awareness and concern. That concern brought about a grass roots movement to clean up the environment that culminated in an "Earth Day" demonstration in April 1970 in which thousands of people called for national action to control the pollution.

There were immediate and strong responses to this call for action. The President established the Environmental Protection Agency to strengthen the Federal response to pollution. The Congress passed the great environmental legislation of the 1970's. That legislation enhanced existing programs and created tough new laws that coordinated local, State, and Federal environmental programs.

ENVIRONMENTAL PROGRESS

It has been ten years since I left EPA. Over these ten years the Agency has accumulated the knowledge and experience that allows us to look back and assess how well the environmental laws have worked and how effective the concerted action of EPA, State, and local governments have been.

It is particularly important to make that assessment now, as the Congress is considering how to reauthorize much of the environmental legislation that guides us. To fully appreciate this legislation and its effects, consider where we would have been without it.

Our experience with environmental cleanup over the past 13 years illustrates that

> "OUR EXPERIENCE WITH ENVIRONMENTAL CLEANUP OVER THE PAST THIRTEEN YEARS ILLUSTRATES THAT ECONOMIC GROWTH AND ENVIRONMENTAL PROTECTION CAN COEXIST."

Preceding page blank

economic growth and environmental protection can coexist. Since 1970 our population has grown by over 13 percent, our economy by over 40 percent. With such development came expanded industrial development and urban growth that, if left unregulated, could have greatly accelerated the deterioration of environmental quality. Our manufacturing sector expanded by 36 percent, growth that might easily have spelled disaster for the Nation's waterways and air quality. Higher prices for oil and gas meant greater reliance on coal, a less "clean" fuel. The number of motor vehicles on the Nation's highways increased by 44 percent.

Notwithstanding all this growth, environmental actions taken during the 1970's have resulted in tremendous progress. The great majority of industries across the country have installed the equipment necessary to control their pollution. Cities have spent substantial sums of money for safe treatment and disposal of their sewage and other waste. These and other efforts have resulted in visible environmental progress. For example:

- In the late 1960's, Lake Erie was one of the most tragic cases of pollution in the Nation. Large blankets of green slime lined its shores, with fishing populations impaired and many beaches closed out of concern for public health. Today Lake Erie's beaches are open for swimming, and sport fishermen caught three million walleyed pike last year.
- Many major metropolitan areas, including New York, Philadelphia, Detroit, Chicago, and Los Angeles, have significantly improved the quality of their air by controlling emission of air pollutants from industrial and municipal sources and by requiring adequate maintenance of cars, trucks, and buses.
- In the early 1970's, residues of numerous pesticides, herbicides, and toxic substances were beginning to be detected in surface waters and wells across the Nation, as well as in the tissue of fish and other wildlife, and were thought to be responsible for the abrupt decline of a number of species of fish and wildlife. Since that time, numerous substances have been banned, or their use has been restricted. Standards for allowable limits have been established for many others.

> "WE ARE STILL OPERATING ON THE FRONTIERS OF KNOWLEDGE IN ATTEMPTING TO ASSESS THE RISKS ASSOCIATED WITH DIFFERENT LEVELS OF HUMAN EXPOSURE TO POLLUTANTS."

These accomplishments have been achieved without a loss in public support. A survey conducted in 1980 by Resources for the Future dramatically illustrated the continued strong public interest in and support of the environmental movement. Among the findings of the poll were that:

- Nearly three-quarters of all Americans consider themselves to be environmentalists at least to some degree, and 42 percent think that "protecting the environment is so important that requirements and standards cannot be too high, and continuing improvement must be made regardless of cost."
- Americans generally are not in favor of protecting the environment at the expense of an adequate energy supply, but ... "forced to make a choice a strong majority of people will choose environmental quality over [economic] growth."
- Sixty-four percent of those polled said they were concerned "a great deal" about the disposal of hazardous industrial chemical wastes, while only nine percent said they were concerned "not much" or "not at all."
- Seventy-three percent felt that endangered species must be protected, even at the expense of commercial activity,

and 65 percent said marshes and swamps should be preserved in their natural state, instead of being drained for development.

The strength of the American people's commitment to environmental quality is underscored by this and other, even more recent, survey findings that support does not vary among people with different backgrounds, jobs, education or income. Support for protecting our environment is a fact of life.

THE CHALLENGES AHEAD

The environmental victories of the seventies notwithstanding,continued progress will be much more difficult. The environmental challenges of the 1980's are much more complex than the ones we tried to address in the 1970's, and they will not yield quickly to our efforts. As the science and administration of environmental protection have become more sophisticated, we have learned of many subtle and potentially more dangerous threats to public health and the ecology. These stem from environmental contamination from minute concentrations of thousands of man-made chemicals found ubiquitously in our technological society. Such contamination by these "toxic" chemicals presents health and other risks about which we still have only limited knowledge. Indeed, our present knowledge is such that we may exaggerate the risks in some cases while in others be unaware of them.

These challenges are even more difficult because we are now aware of how interrelated pollution is and of how some actions to eliminate pollution merely transfer it from one place to another.

In setting out to find solutions to the environmental issues of the eighties and nineties, we start with a healthy appreciation of the difficulties involved. Finding the evidence of contamination, assessing the threat, correcting the damage, setting up preventive measures, and paying the price of protection—all raise questions of science, technology, and public policy that are as difficult as they are important. In a number of cases, we must decide whether the very fear of risk is sufficient cause to act or whether we must await more certain evidence that the risk is real. In these and other cases, we lack both certainty as to the degree of risk and proven technology to remove it. In nearly every case, the cost of protection gives pause to any public servant who must weigh the investment of public or private funds against the value of the protection to be purchased. We must make judgments with whatever information we have and expect to learn more as we go.

I believe that EPA's highest priorities for meeting our future and its challenges are to maintain progress, improve our understanding and knowledge, and anticipate new challenges. All this must be done while strengthening our partnership with State and local governments and maintaining public support and trust.

Maintain Progress

The first thing we must do is to make sure we maintain the success we have worked so hard to achieve in the past 13 years. Industries have installed billions of dollars in pollution control equipment, but they must now work to operate and maintain it properly. Municipalities must set aside adequate resources and retain well-trained staff to keep their sewage treatment works functioning properly, as well as cope with additional waste generated by growing populations. A major EPA priority for the next few years is to ensure that both industrial and municipal facilities comply continually with environmental requirements. If we should relax our enforcement efforts, the progress made in the past decade would quickly erode. Therefore, we will continue to insist on vigorous compliance programs, including monitoring and enforcement, so that States or EPA can take whatever remedial action may be necessary.

Improve Our Understanding and Knowledge

While there have been significant breakthroughs in all aspects of environmental science in the last decade, we are still operating on the frontiers of knowledge in attempting to assess the risks associated with different levels of human exposure to pollutants. The ramifications of this uncertainty for EPA are significant as critical decisions often must rest on controversial scientific judgments. Instead of denying the uncertainties, our approach will be to articulate them. One of my highest priorities is to develop a systematic approach to determining all the factors that need to be considered in making such decisions. My objective is to ensure that our decisions are based on high-quality data and rigorous analysis. In addition, we will place increased emphasis on improving the quality of the scientific information we use to support our decisions.

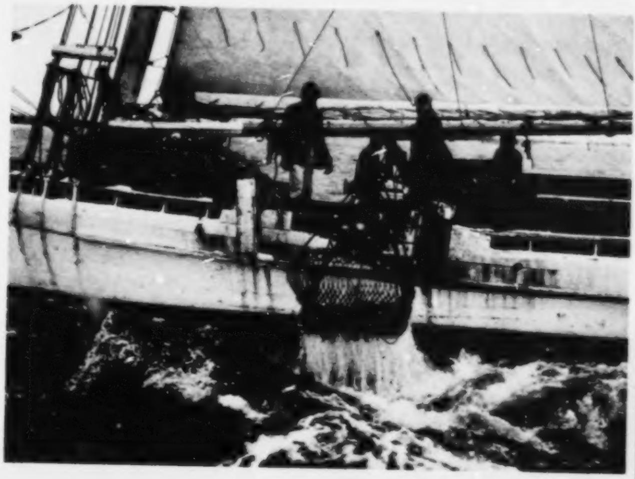
I am convinced of the importance of a balanced research approach. While program needs must be met, a certain percent of EPA's research should be dedicated to improving our understanding of fundamental scientific uncertainties that currently cloud our decisions. The most important of these areas include:

- The relationship of single chemical toxicities found in laboratory animal studies to the human health impacts that may result from long-term, relatively low-level environmental exposures to a multitude of chemicals;

- The actual fate of pollutants in the environment; and

- The means to measure systematically environmental improvements or to identify emerging contamination problems before they become environmental crises.

Whether or not it is immediately applicable to a specific regulatory or other action, well-planned research in these areas will undoubtedly pay dividends in the long run.



Anticipate New Challenges

Changes in population and technology, and economic, industrial, and agricultural growth are influencing our current environmental problems and presenting new environmental challenges. Rapid population growth coupled with extensive energy development in the West, for example, is putting severe strains on natural resources in this area, particularly water resources. At the same time, the lack of growth in some of the country's older cities is, in some cases, creating problems of financing basic environmental services such as sewage treatment. In areas where there is a trend toward widely dispersed, high-technology facilities, there is the possibility of discharges of small amounts of unusual chemicals into rural treatment systems not designed to handle them. The growing popularity of wood stoves may present air pollution problems that will be difficult to control. New agricultural processes, such as "no-till" farming and expanded irrigation, could affect the amount of pesticide runoffs into nearby water supplies. On the other hand, advances in biotechnologies hold the promise for chemical processing methods that are more environmentally benign or perhaps organisms capable of rapidly and cheaply detoxifying hazardous waste or spills. But such new technologies also convey environmental concerns as their public health and environmental consequences are not known.

While we have made environmental gains in the past, we need to constantly anticipate and evaluate the potential effects of these changes. Moreover, we must carefully balance environmental goals with the Nation's other social and economic needs, including economic growth and technology leadership.

Build a Stronger Partnership with the States

EPA's role in environmental protection is essential but not sufficient to bring about the genuine change we need. Over the past several years, States have increasingly taken over full management and operation of environmental pro-

grams. In fact, it is fair to say that States are now the actual operating arm of the national network for environmental protection. As States conduct the lion's share of day-to-day permitting and enforcement, EPA's role must shift to emphasize national leadership and support of States. Our Federal Agency will continue to set national standards to be administered by States, but we will also concentrate on providing States the tools they need to succeed. That means research and technical support directed to meet the needs of States in their everyday work. EPA remains responsible for national program success, but we will increasingly account for the contributions of State programs to our country's environmental health.

Ensure Understanding of Choices

If the Nation is to continue to make progress in preventing and abating contamination of our environment, EPA's efforts must be undertaken with the full understanding, cooperation, and participation of the public, industry, and government. We will often have to debate and come to some agreement on how to balance our desire and need for a clean environment with other economic and social needs.

The challenges ahead will demand more than the skill and commitment of EPA staff working with many other governmental agencies for environmental protection. Public support will continue to be vital in maintaining the momentum of past success. But the public support also places a responsibility on us at EPA and on other public servants to educate and inform the American people on the difficulties we face and the tough tradeoffs future environmental decisions will entail.

THE NATIONAL ENVIRONMENTAL REPORT

Upon returning to EPA, I have consistently stressed the need to have greater public involvement in our decisions. This public involvement can take two forms. The first is through citizens making their opinions known on key environmental issues by participating in local government decisions and by writing EPA, the President, or their representatives in Congress. This type of involvement is crucial if we are to resolve the many conflicts in values which we now face. The initial responsibility of this involvement lies with EPA. We must make an effort to get proposals to the public for a meaningful dialogue to take place.

The second form of public involvement is a very concrete one. No matter what laws are passed for the protection of the environment, no progress will be made without the fullest support of the American people. This public support, however, places a great responsibility on us to inform and to educate. EPA publishes this report as a means of accounting to the American public for our stewardship of public funds over the past 13 years. I believe the report demonstrates that our accomplishments to date have been well worth the investment. But there is more to do. An equally important reason for publishing this report is to alert the public to some of the most difficult environmental problems the Nation is now facing. We at EPA cannot succeed if the American people are not aware of the complexity of the problems and the difficulty of the choices ahead. I hope this report encourages understanding and opens the dialogue so essential to better, more informed decisions and actions by EPA on behalf of this country and our world's most precious resources.

William D. Ruckelshaus

> "NO MATTER WHAT LAWS ARE PASSED FOR THE PROTECTION OF THE ENVIRONMENT, NO PROGRESS WILL BE MADE WITHOUT THE FULLEST SUPPORT OF THE AMERICAN PEOPLE."

AIR

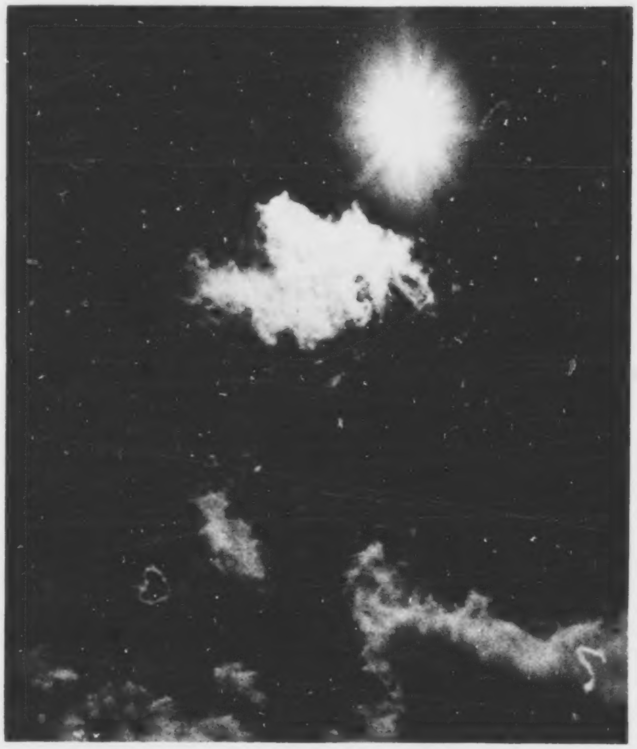
Preceding page blank

AIR

Most Americans over 30 can remember seeing clouds of pollution cover a city and feeling their eyes smart and lungs begin to tighten up when passing near industrial areas. For good reason, air pollution has been a major health and environmental concern for several decades.

- There were instances in the late 1940's and early 1950's, both in the United States and other countries, where air pollution levels were so bad that people were hospitalized and many died.
- Many urban areas were perpetually enveloped in a smoky haze, as industries emitted thousands of tons of pollutants into the air with few or no controls.
- Dirt and grime from the air were commonplace in homes, on laundry hung outside to dry, and on buildings, cars, and vegetation.

Over the last 13 years, we have made significant progress. Levels of air pollution are consistently lower. Days when air pollution makes it unhealthy to be outside are far less frequent. Most industries have put pollution controls in place, and many communities have restricted open burning and other practices that contribute to local air pollution problems.



However, many traditional air quality problems still remain, and new ones are emerging. This chapter begins with an overview of EPA's approach to air pollution control and the progress achieved so far. It then discusses eight major air pollution issues facing the Nation and how EPA plans to address them.

Preceding page blank

AN OVERVIEW

Despite considerable improvement in air quality over the past decade, air pollution of some sort is found in nearly every area of the United States. It is particularly severe in urban areas. Air pollution can cause both health and environmental damage. Some of the health problems brought on or aggravated by air pollution include lung diseases, such as chronic bronchitis and pulmonary emphysema; cancer, particularly lung cancer; neural disorders, including brain damage; bronchial asthma and the common cold, which are more persistent in places with highly polluted air; and eye irritation (Figure A-1). Environmental problems range from damage to crops and vegetation to increased acidity of lakes that makes them unsuitable for fish and other aquatic life.

As early as the 1940's it became clear air pollution was a serious problem. In the late 1940's, Los Angeles took measures to control its smog problem. However, States and local governments were generally reluctant to impose tough requirements on industry which might make other States seem more attractive places for industry to locate. To address air pollution more effectively, it became necessary to develop a national approach.

In 1963, Congress passed the Clean Air Act (CAA), which authorized the U.S. Public Health Service to study air pollution and to provide grants and training to State and local agencies to control it. This legislation was strengthened considerably when the Clean Air Act Amendments of 1970 were signed into law, making the recently created EPA the focal point of the Federal effort.

The 1970 amendments to the Clean Air Act required EPA to set National Ambient Air Quality Standards for "criteria air pollutants." These are air pollutants found commonly throughout the country. EPA has identified six criteria pollutants: ozone, carbon monoxide, total suspended particulates, sulfur dioxide, lead, and nitrogen dioxide. For these pollutants, primary standards are set to protect human health and secondary standards to protect what the Act refers to as "welfare," primarily crops and livestock, vegetation, buildings, and visibility. For some of these pollutants, one standard has been set that protects both health and welfare.

The Clean Air Act Amendments also require EPA to review and regulate hazardous air pollutants. These pollutants are defined as those that can contribute to an increase in mortality or in serious illness but which are not already regulated as criteria pollutants. EPA is cur-

FIGURE A-1

HEALTH CONCERNS OF THE REGULATED AIR POLLUTANTS

Criteria Pollutants	**Health Concerns**
Ozone	Respiratory tract problems such as difficult breathing and reduced lung function. Asthma, eye irritation, nasal congestion, reduced resistance to infection, and possibly premature aging of lung tissue.
Airborne Particulates	Eye and throat irritation, bronchitis, lung damage, and impaired visibility.
Carbon Monoxide	Ability of blood to carry oxygen impaired. Cardiovascular, nervous, and pulmonary systems affected.
Sulfur Dioxide	Respiratory tract problems; permanent harm to lung tissue.
Lead	Retardation and brain damage, especially in children.
Nitrogen Dioxide	Respiratory illness and lung damage.
Hazardous Air Pollutants	
Asbestos	A variety of lung diseases, particularly lung cancer.
Beryllium	Primarily lung disease, although also affects liver, spleen, kidneys, and lymph glands.
Mercury	Several areas of the brain as well as the kidneys and bowels affected.
Vinyl Chloride	Lung and liver cancer.

Reproduced from
best available copy.

rently analyzing a number of air pollutants to determine whether they are hazardous and require regulation. The Agency already has issued standards for four of these pollutants: asbestos, beryllium, mercury, and vinyl chloride.

SOURCES OF THE PROBLEM AND EPA's APPROACH

Both criteria and hazardous air pollutants come from two major categories of sources, mobile sources and stationary sources. Mobile sources include passenger cars, trucks, buses, motorcycles, boats, and aircraft. Stationary sources range from iron and steel plants and oil refineries to dry cleaners and gas stations.

Under the Clean Air Act, as amended, State and local governments have primary responsibility for the control and prevention of air pollution. EPA is responsible for setting national standards to protect public health and welfare, conducting research on

Darkness at noon: Pittsburgh during the 1940s before air pollution control efforts

REQUIREMENTS FOR NEW FACTORIES

When a company wants to build a new factory in an area, they need to comply with the requirements of several different EPA and State air programs. The following briefly explains the kinds of requirements a new plant might be required to meet under the Clean Air Act.

First the State would need to ensure that the plant's pollution control equipment limited emissions of the criteria pollutants to at least meet the New Source Performance Standards (NSPS). *These standards, set by EPA, limit the amount of the criteria pollutants that are allowed from new sources or from existing sources which have been modified, based on use of the best demonstrated control systems. The New Source Performance Standards are uniform national standards. States may impose further restrictions if they desire or if they are necessary for the area to meet the National Ambient Air Quality Standards (NAAQS). If the area was already exceeding the ambient standards for a pollutant, the State may require the factory to either not emit any of the pollutant or pay some other facility which can limit its emissions at a lower cost.*

However, criteria air pollutants are not the only pollutants the plant must control. The plant must also meet National Emissions Standards for Hazardous Air Pollutants (NESHAPS) *for any hazardous air pollutant it might emit. Under the law, a hazardous air pollutant is one that is not covered by an ambient air quality standard and may cause "an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." EPA is required to set national emissions standards to "provide an ample margin of safety to protect the public health" from each hazardous air pollutant.*

In addition to these two programs, if the plant is in an area where air quality is already good, it must be permitted under the Prevention of Significant Deterioration (PSD) *program. State and Federal permits in this program are intended to restrict emissions from new or modified sources in places where the air quality is already better than required to meet primary and secondary ambient air quality standards. In certain areas, such as national parks, only very small incremental increases in pollution may be allowed. In no area subject to the PSD program are increases allowed which would degrade air quality below the national standards.*

Reproduced from
best available copy.

prevention and control of air pollution, and providing technical and financial assistance to State and local governments for air pollution control. Each State must draw up a State Implementation Plan (SIP) describing how it will control emissions from mobile and stationary sources in order to meet National Ambient Air Quality Standards (NAAQS).

Mobile Sources

Mobile sources of air pollution produce more than half of all air pollution emissions. Exhaust from mobile sources contains carbon monoxide, volatile organic compounds, nitrogen oxides, particulates, and lead. All of these pollutants, except volatile organics, are regulated as criteria air pollutants, and EPA has set ambient standards for them. Although volatile organic compounds are not regulated as a criteria pollutant, their emissions are controlled because of their role in ozone formation.

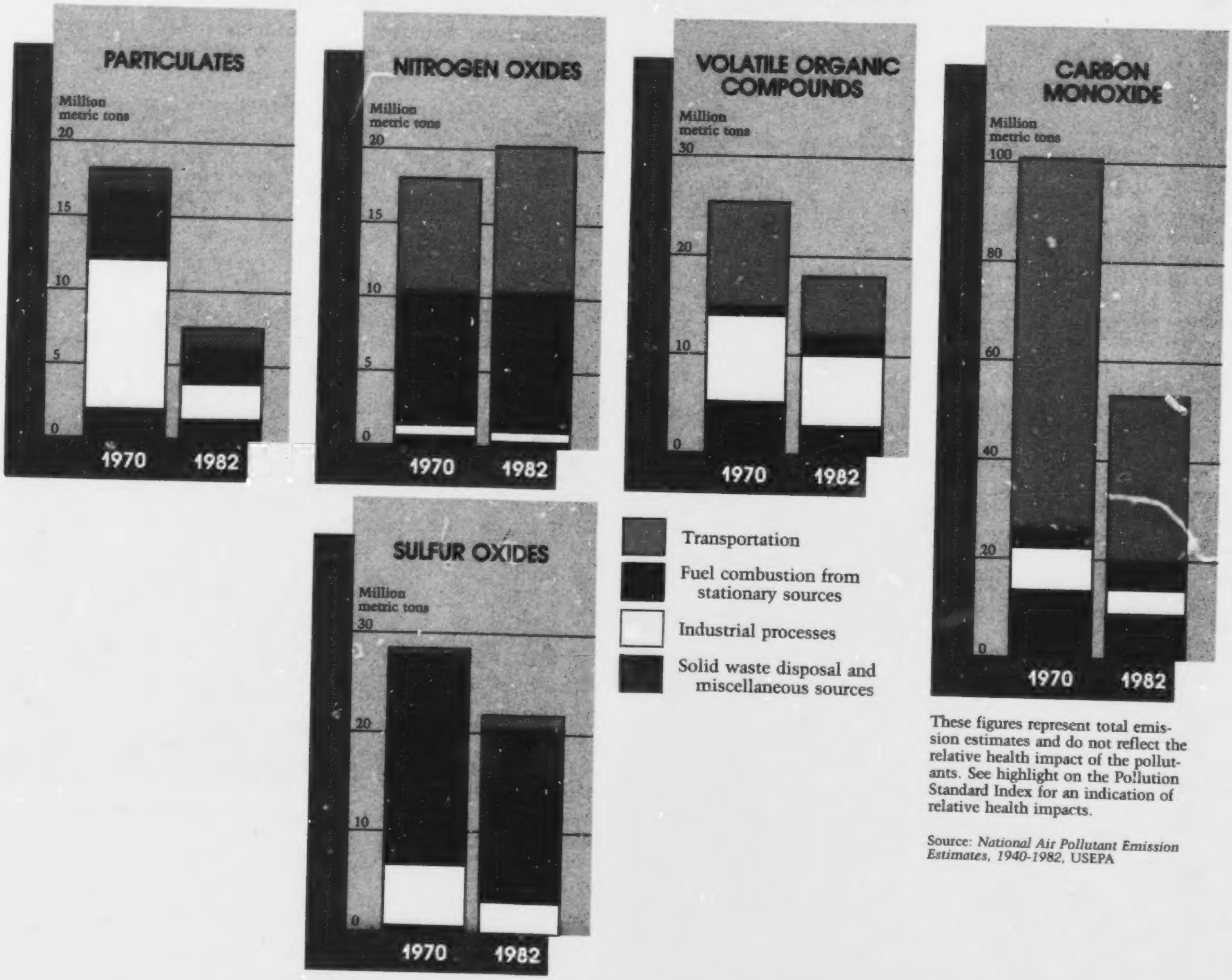
EPA has tried to control the emission of these pollutants from motor vehicles through the Federal Motor Vehicle Control Program (FMVCP). Under this program, EPA sets national emission standards for carbon monoxide, nitrogen dioxide, volatile organic compounds, and particulates and requires car manufacturers to design new cars so that they meet those standards. EPA and State and local governments also support and operate inspection and maintenance programs to test emission levels of cars in use. In addition, State and local governments try to meet ambient standards by encouraging public transportation systems and improving traffic patterns.

Stationary Sources

Stationary sources generate air pollutants as by-products of fuel burning and industrial processes. Electric utilities, industrial facilities, and residential and commercial buildings are the principal contributors of the pollution generated by burning coal, oil, natural gas, wood, and other fuels. The pollutants produced include sulfur dioxide, nitrogen oxides, carbon monoxide, and

FIGURE A-2

CRITERIA POLLUTANT EMISSIONS HAVE GONE DOWN



These figures represent total emission estimates and do not reflect the relative health impact of the pollutants. See highlight on the Pollution Standard Index for an indication of relative health impacts.

Source: *National Air Pollutant Emission Estimates, 1940-1982,* USEPA particulates. The by-products of industrial processes generate these same pollutants as well as volatile organic compounds and lead.

Hazardous air pollutants come from a variety of industrial and manufacturing processes. In addition, fuel oils contaminated with toxic chemicals, hazardous waste disposal facilities, municipal incinerators, and electric utilities may also be sources of hazardous air pollution.

EPA relies heavily on the States to control emissions from stationary sources. States review whether they are meeting ambient standards for individual criteria pollutants. Where they are not meeting these standards, they develop plans to achieve them. Once these State Implementation Plans are developed, the States or EPA writes specific permits limiting the emissions from individual facilities. They monitor the facilities to ensure they comply with emissions limits and take action against violators.

EMISSIONS TRADING

EPA is using several innovative policies that encourage industries to control their emissions by making it less costly for them to do so. Collectively these policies are known as "emissions trading." Emissions trading is based on the principle that a pound of a pollutant is a pound of a pollutant, regardless of its source. This allows a plant complex with several facilities to decrease pollution from some while increasing emissions from others as long as each trade produces results equivalent to or better than the previous limits.

One form of emissions trading is the "bubble" policy. Rather than regulating emissions from each smoke stack at a facility, the policy limits emissions from the facility as a whole - as if it were enclosed in a bubble. This gives a factory or other facility the flexibility to control emissions of comparable pollutants as inexpensively as possible.

Under the bubble policy many plants and factories have made significant progress in reducing emissions while saving millions of dollars. For example, a factory in Bristol, Pennsylvania used a new process for controlling certain emissions of volatile organic compounds (VOCs) in exchange for less strict control over some other VOC emissions. This trade reduced VOC emissions by 1,000 tons per year below the limits that would have been set under a conventional compliance policy. The company saved three million dollars initially and reduced its operating costs by over one million dollars per year.

EPA also allows facilities to "bank" credits when their emissions fall substantially below their compliance limits. They can use these credits later when high production demands cause a temporary increase in emissions. Alternatively, they may sell the credits to other industries that would require more costly means to control the same amount of pollution. Emissions trading and banking is one way EPA makes it possible to achieve environmental and economic progress simultaneously.

PROGRESS TO DATE

EPA and State and local governments have taken many of the necessary steps to control air pollution. Most industries now have air pollution control equipment in place. New cars are built to standards that represent a reduction of about 95 percent for volatile organic compounds and carbon monoxide and 75 percent for nitrogen oxides. Because the principal design changes made to reduce emissions require use of unleaded gasoline, a side effect of design changes has been significant reductions in lead emissions. These emission reductions from mobile and stationary sources have resulted in considerably lower ambient levels of all the pollutants and far fewer communities with pollution levels exceeding air quality standards.

Air Pollution Emissions

A recent report prepared by EPA's Office of Air and Radiation concludes that air pollution emissions from all types of sources and for almost all pollutants were reduced dramatically between 1970 and 1982 (Figure A-2).

- **Particulate** annual emissions have been reduced by 58 percent since 1970 because industries have installed air pollution control equipment and because there is less burning of solid waste.
- **Sulfur dioxide** emissions increased from 1970 through 1973 as a result of increased burning of coal and other fossil fuels. Since then, however, sulfur dioxide emissions have decreased as a result of the installation of controls at coal-fired power plants, the burning of less coal by other sources, and reduced emissions from smelters.
- **Nitrogen oxide** emissions overall have increased slightly. Emissions from transportation sources increased through 1978 because of increased motor vehicle travel but have declined slightly since then. Electric utility emissions increased due to greater use of fossil fuels. Industrial emissions decreased slightly.
- **Volatile organic compounds** annual emissions, which along with nitrogen oxides are contributors to ozone formation, decreased by about 28 percent between 1970 and 1982. This has been due primarily to the Federal Motor Vehicle Control Program and less burning of solid waste.
- **Carbon monoxide** annual emissions from transportation sources and industrial processes declined about 27 percent, as did emissions from burning of solid waste and agricultural refuse.
- **Lead** emissions decreased 69 percent between 1975 and 1982.

Ambient Levels

EPA and the States measure levels of criteria pollutants in the ambient air by using a network of monitors across the country. Because the monitors are deliberately concentrated in cities, where there is the greatest potential for exposure, there is an urban bias to the data. In general, however, the data reliably show trends in air quality. Data from this network for the period from 1975 to 1982 show that ambient levels of all criteria pollutants are down nationwide (Figure A-3).

- **Particulate** levels decreased 15 percent between 1975 and 1982. While emissions decreased 27 percent during this period, ambient levels only decreased by about half this

Reproduced from best available copy.

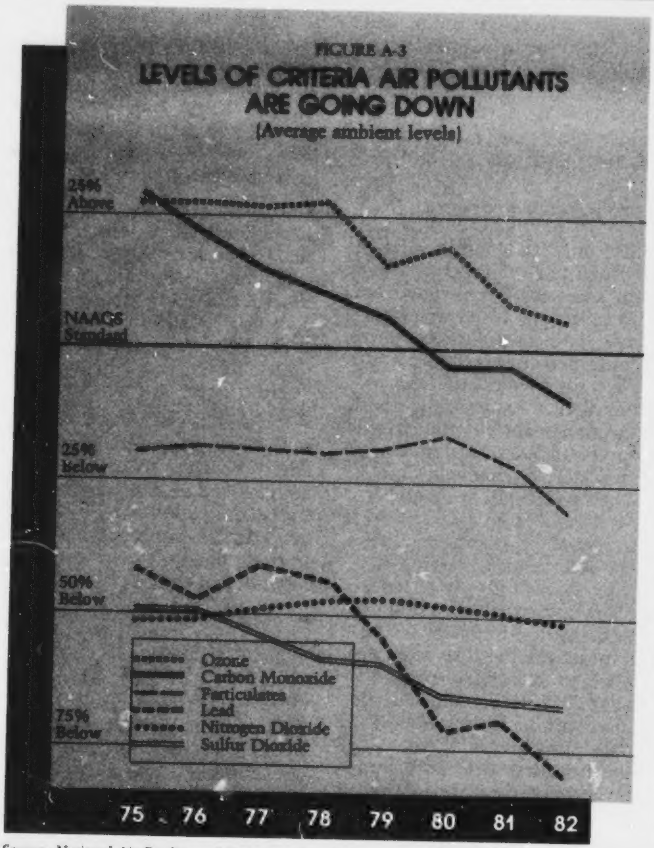


FIGURE A-3

LEVELS OF CRITERIA AIR POLLUTANTS ARE GOING DOWN

(Average ambient levels)

Source: *National Air Quality and Emissions Trend Report, 1982,* USEPA

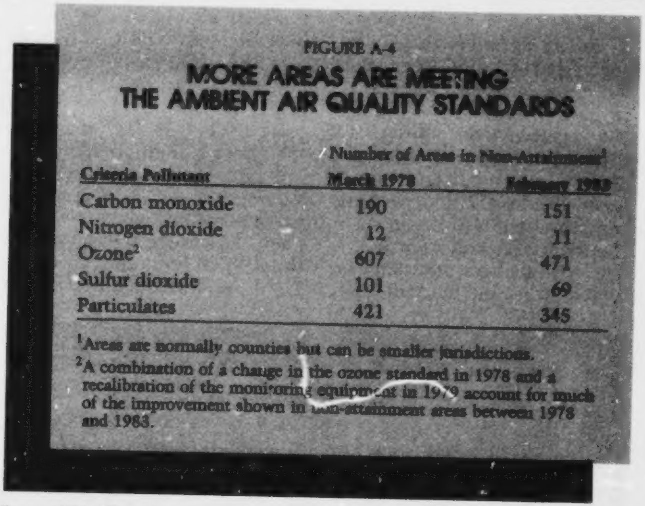


FIGURE A-4

MORE AREAS ARE MEETING THE AMBIENT AIR QUALITY STANDARDS

Criteria Pollutant	Number of Areas in Non-Attainment[1] March 1978	February 1983
Carbon monoxide	190	151
Nitrogen dioxide	12	11
Ozone[2]	607	471
Sulfur dioxide	101	69
Particulates	421	345

[1] Areas are normally counties but can be smaller jurisdictions.

[2] A combination of a change in the ozone standard in 1978 and a recalibration of the monitoring equipment in 1979 account for much of the improvement shown in non-attainment areas between 1978 and 1983.

Source: EPA's Office of Air Quality Planning and Standards

much because of the large amounts of natural wind-blown dust, as well as dust from streets and construction sites.

- **Sulfur dioxide** levels decreased 33 percent between 1975 and 1982.

- **Nitrogen dioxide** levels increased between 1975 and 1978, but dropped between 1979 and 1982. The 1982 level was the same as the level in 1975 and well below the ambient standard.

- **Ozone** levels decreased 18 percent between 1975 and 1982, and exceedances of the ambient standard during the ozone season (July-September) during these years dropped even more dramatically, by 49 percent. Part of this decrease can be accounted for by a calibration change in the monitoring equipment in 1979.

- **Carbon monoxide** levels dropped 31 percent between 1975 and 1982. Moreover, exceedances of the ambient standard dropped 87 percent during this period.

- **Lead** levels decreased nationally 64 percent between 1975 and 1982, primarily because of a drop in the use of leaded gasoline.

Areas Meeting Ambient Standards

Across the Nation, we have made considerable progress in meeting air quality standards. As shown in Figure A-4, many more areas are now attaining standards for ozone, particulates, sulfur dioxide, and carbon monoxide than in 1978. (Lead nonattainment was not reported at that time, so there is no basis for comparison.)

TODAY'S AIR QUALITY CHALLENGES

Although we have made considerable progress in controlling air pollution from both mobile and stationary sources, much still needs to be done. Five of the six criteria pollutants, all except nitrogen dioxide, are currently of major concern in a number of areas of the country. There are many counties or portions of counties where health-related standards for one or more of the criteria pollutants are not being met.

In addition, certain areas still have levels of pollution on some days that are far in excess of those considered safe for the protection of human health and the environment. For example, in 1981, the Los Angeles metropolitan area violated ozone standards 165 days of the year, with levels sometimes as much as four times higher than the ambient standard.

EPA also needs to do more work to determine the extent and nature of problems with hazardous air pollutants. One of EPA's highest priorities for the next two years is to develop and implement an effective national air toxics program. As part of this program, EPA will provide guidance and assistance to States in monitoring and controlling these pollutants. In addition, we need to make considerably more progress in understanding acid rain.

The rest of this chapter focuses on eight of the most significant air quality challenges that now face the Nation. These challenges are:

- **Ozone**. Although much progress has been made in reducing ozone levels, people in several areas across the Nation continue to be exposed to high concentrations of this pollutant. In a number of major metropolitan areas, it is unlikely that the ozone standard will be met because it would require reductions in emissions of volatile organic compounds of as much as 40 to 85 percent.

- **Airborne particulates**. Numerous areas of the country continue to violate particulate standards. A number of these areas are rural sites with natural wind-blown dust which, because it consists of large particles, is not a health threat. In other areas, however, large numbers of people are exposed to particulates that are the product of industrial processes, wood and coal burning, and motor vehicles. These particulates, which consist of both large and small particles, can damage cars, buildings, and vegetation. The smaller particulates can also cause serious health problems including throat irritation and lung damage. EPA has proposed refocusing its regulations to control these small particulates because they constitute the greatest health threat.

- **Carbon monoxide**. Carbon monoxide, which is produced primarily by motor vehicles, is most severe in urban areas. Where it is a problem, it is considered serious because of its effects on health. These effects include aggravation of heart and lung disease and impaired mental functioning and alertness.

- **Sulfur dioxide**. Sulfur dioxide is a product primarily of fossil fuel combustion by electric utilities. While only a few areas are classified as nonattainment for this pollutant, it remains a concern both because it can have serious effects on health and because it plays a role in the formation of acid deposition.

- **Airborne lead**. Levels of airborne lead have decreased dramatically due to the increased use of unleaded gasoline. However, lead is still a concern in many areas, particularly near current or former sites of lead smelting operations.

- **Airborne toxics**. There is increasing evidence that many toxic compounds are transported through the air. Some of these chemicals may pose both immediate and long-term health problems, including respiratory illness, cancer, and birth defects. The issues involved in controlling toxics are complicated since it is not clear what effects these substances have at the very low levels found in the ambient air.

- **Acid deposition**. Acid is formed in the air primarily as a result of the interaction between sulfur dioxide or nitrogen dioxide and water. This acid not only affects the area where it was emitted but often falls to earth far from the original sources of these pollutants, making control measures complicated and controversial. Some lakes and streams have become so acidic that they cannot support fish or other aquatic life. It is reported that acid deposition may also damage crops, vegetation, and forests.

- **Indoor air pollution**. Indoor air can become polluted by cigarette smoke, building materials, fumes from heating and cooking devices, and a variety of other sources. Levels of pollutants inside buildings may be much higher than levels outdoors. Because Americans spend an average of 80 to 90 percent of their time indoors, there is increasing concern about this problem.

THE POLLUTANT STANDARDS INDEX

The Pollutant Standard Index (PSI) is a general measure of air quality that is familiar to many people because it is often included in local weather reports. It is a simple and consistent way of communicating the adverse health effects of air pollution levels in major cities. Daily PSI values are especially important to people with illnesses that are aggravated or caused by air pollution. This table presents the elements of the index and the way the PSI values are calculated.

The Pollution Standard Index measures five of the six criteria air pollutants: carbon monoxide, ozone, sulfur dioxide, total suspended particulates, and nitrogen dioxide. It was designed so that other pollutants can be included in the index without changing it. Ambient levels of each pollutant are rated on one standardized scale of PSI values which ranges from zero to 500: from "good" to "hazardous" air quality. For each pollutant, a value of 100 corresponds to its National Ambient Air Quality Standard with an averaging time of not more than 24 hours, the highest level of the pollutant which is still regarded as safe.

Index values for individual pollutants are reported separately. Weather reports most frequently give the pollutant which had the highest value occurring that day and its numeric value on the scale. Health effects descriptions and appropriate cautionary statements are provided for use by the news media in reporting each level of air quality.

		POLLUTANT LEVELS					
Index Value	Air Quality Level	Particulates (24-hour), μg/m³	Sulfur Dioxide (24-hour), μg/m³	Carbon Monoxide (8-hour), mg/m³	Ozone (1-hour), μg/m³	Nitrogen Dioxide (1-hour), μg/m³	Health Effect Descriptor
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	50% of NAAQS	75	80	5.0	120	a	Moderate
0		0	0	0	0	a	Good

a No index values reported at concentration levels below those specified by "Alert Level" criteria.

Source: EPA's Office of Air and Radiation

Reproduced from best available copy.

Ozone

THE PROBLEM

Ozone is still the Nation's number one air pollution problem. Many areas across the country, including a number of the major metropolitan areas, continue to have levels of this pollutant which are higher than EPA's ambient standard (Figure A-7). The major component of smog, ozone can cause serious respiratory problems.

Ozone is produced when sunlight triggers chemical reactions involving volatile organic compounds (VOCs) and nitrogen oxides (NOx). Levels are highest during the day, usually after heavy morning traffic has released large amounts of the precursor pollutants (Figure A-5). Control of these precursors is difficult because their sources are varied and widely dispersed. Motor vehicle traffic is growing so fast and is such an essential aspect of life in many places that even strenuous efforts may not sufficiently reduce emissions. Like motor vehicles, other small sources such as dry cleaners and gas stations, though individually only emitting small amounts of the pollutants, are collectively a significant part of the problem.

Barham Blvd
Lankershim Blvd
Ventura Blvd

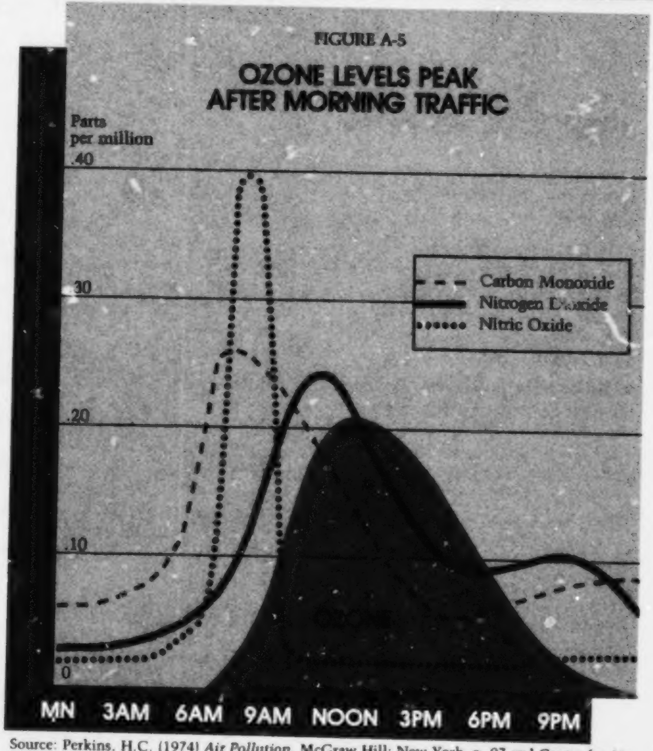


FIGURE A-5

OZONE LEVELS PEAK AFTER MORNING TRAFFIC

Source: Perkins, H.C. (1974) *Air Pollution*, McGraw Hill: New York, p. 97 and Center for Air Environment Studies, Penn State University

EFFORTS TO DATE

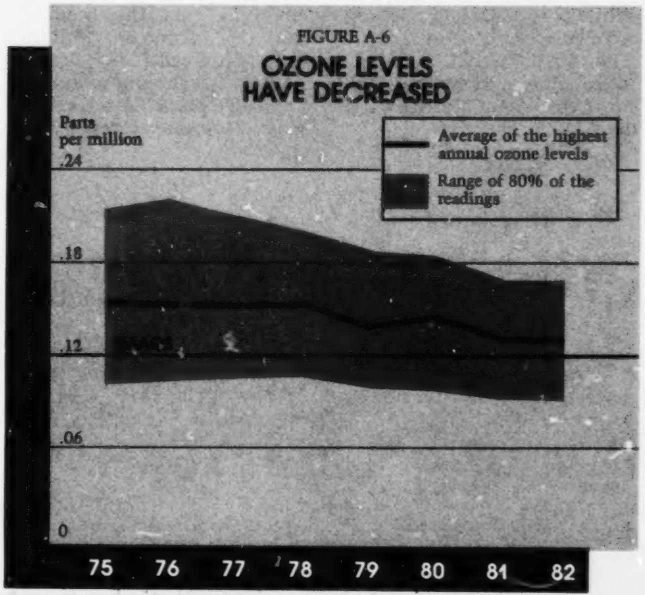
Ozone is one of the six criteria pollutants for which EPA sets ambient standards. Considerable progress has been made in reducing it over the past several years. Ambient levels of ozone nationally fell 18 percent between 1975 and 1982 (Figure A-6). An even more dramatic improvement was seen during the summer months when ozone levels are usually highest. By 1982, the number of violations of the ambient standard during the summer was 49 percent less than in 1975. The number of "nonattainment" areas where the standard was violated more than once a year dropped from 607 in 1978 to 471 in 1983. Some of this recorded improvement, however, is the result of changes in the ambient standard in 1978 and recaliberation of monitoring equipment in 1979. Despite these gains, ozone remains a serious problem in hundreds of urban areas across the country.

In many areas, the greatest contributer to ozone remains motor vehicles. Automobile emissions of ozone-producing chemicals have been reduced considerably since 1970 because all new motor vehicles must now meet EPA emissions standards. This program has been reinforced by automobile inspection and maintenance programs in cities where ozone has been a particularly intransigent problem. Twenty States have inspection programs under way, with eight more expected to begin this year.

Emissions from major stationary sources such as chemical plants, refineries, and industrial processes have been substantially controlled through EPA, State, and local permitting and enforcement efforts. However, some stationary sources such as paint manufacturers, dry cleaners, and gas stations have not been widely controlled. EPA is assessing methods to control a number of these small stationary sources. New emission standards for industries producing synthetic organic chemicals, surface coatings, and pesticides are part of this effort.

FIGURE A-6

OZONE LEVELS HAVE DECREASED

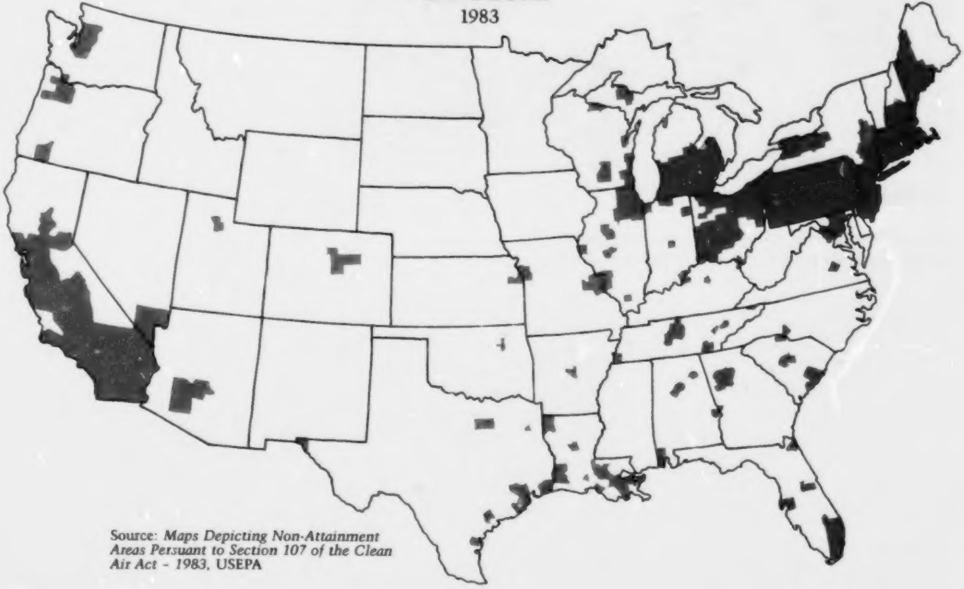


Source: *National Air Quality and Emissions Trends Report, 1982*, USEPA

FIGURE A-7

COUNTIES IN PARTIAL OR TOTAL NON-ATTAINMENT FOR OZONE

1983



Source: *Maps Depicting Non-Attainment Areas Persuant to Section 107 of the Clean Air Act - 1983*, USEPA

TODAY'S CHALLENGES

While considerable reductions have been achieved nationwide, persistently high levels in some areas mean that we must go beyond our efforts to date.

Mobile Sources

Cars made before 1970 are not subject to national emissions programs. In addition, over 13 percent of the cars built since 1975 have had their pollution control devices disabled. These factors make mobile sources a remaining concern.

Discarded catalytic converters and mufflers. Removal of catalytic converters greatly increases a car's ozone-causing emissions.

Small Sources

Small stationary sources were not initially regulated by EPA or States. However, the reductions achieved by controlling automobile and large stationary source emissions have not been sufficient to solve the ozone problem in several areas. Further controls will be required on small stationary sources if the ambient standards are to be met. The costs of controlling these sources, primarily small businesses with slim profit margins, present difficult cost-benefit decisions.

Ozone Transport

Ozone and its precursors are frequently transported across State and national boundaries, creating considerable interstate and international controversy. The lack of consensus in the scientific community on modeling techniques makes these controversies difficult to resolve.

EPA'S AGENDA

Among the criteria air pollutants, ozone is EPA's highest priority. EPA is focusing its regulatory and enforcement efforts on the control of new and existing sources of volatile organic compounds (VOCs). EPA is developing new source emissions standards based on the best control technology for VOCs, particularly for the surface coating and synthetic organic chemical industry.

As required by the Clean Air Act, EPA has begun the periodic reevaluation of the National Ambient Air Quality Standard for ozone. As part of this process, EPA must consider any new research on the health or environmental risk of ozone and determine whether the present standard needs to be modified.

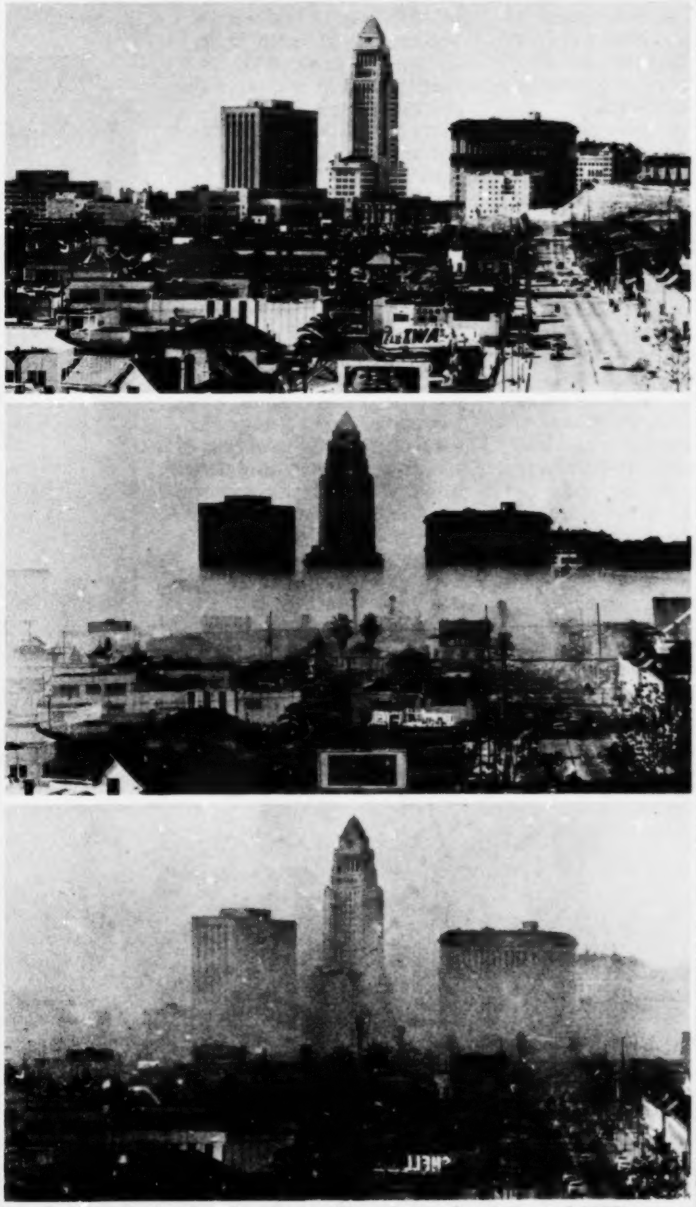
For States with one or more of the 154 counties granted extensions until 1987 to attain the ozone standard, EPA is helping develop and implement mobile and stationary source controls. EPA is also trying to help resolve interstate disputes over ozone transport with models predicting the possible path of pollutants. These models work in much the same way as weather forecasting models. In addition, EPA is planning a special study to determine what changes may be needed in State Implementation Plans in the areas where the air still fails to meet the health-related standard. Where compliance is past due and an extension has not been granted, EPA will require more stringent control efforts and impose sanctions if States fail to take necessary actions.

OZONE IN THE SOUTH COAST AIR BASIN

With a population of 10.3 million people, the Los Angeles metropolitan area, also known as the South Coast Air Basin, continues to have the most serious ozone problem in the Nation. The same attributes that lured millions of people to the Basin area contribute to this ozone problem. Constant sunshine, light ocean breezes, and nearby mountains concentrate the pollutants which facilitate ozone formation. The Basin's large population, reliance on automobiles, petroleum industry, and numerous small sources of precursor pollutants make the problem extremely hard to control.

Ozone concentrations in the Basin have declined over the period from 1965 to 1982. Peak concentrations in all areas of the Basin are well below the historic highs. Recognizing the significant contribution automobiles make to the ozone problem, California imposed the strictest auto emission standards in the Nation. According to one estimate, however, volatile organic compound (VOC) emissions need to be reduced by 85 percent from 1979 levels in order to meet the health-related ozone standard by 1987, the statutory deadline. Under the current plan, the Basin is only expected to achieve a 57 percent reduction in VOC emissions by 1987.

Continued population growth and a heavy reliance on automobiles pose formidable obstacles to meeting the ozone standard. The population in the Basin is expected to rise to 13.6 million by the year 2000. Auto travel and the number of small sources of volatile organic compounds (such as dry cleaners) are also expected to increase. For the Basin to meet the ozone standard, there must be a great deal of public support.



Los Angeles developed a smog problem during the 1940's and 1950's.

Airborne Particulates

THE PROBLEM

Particulates in air such as dust, smoke, and aerosols may have both acute and long-term health and environmental effects. These effects range from irritating the eyes and throat and reducing resistance to infection, to causing chronic respiratory diseases. Fine particulates, about the size of cigarette smoke particles, can cause temporary or permanent damage when they are inhaled deeply and lodge in the lungs (Figure A-10). Some particulates, such as those from diesel engines, are suspected of causing cancer. Others, such as windblown dust, can carry toxic substances such as polychlorinated biphenyls (PCBs) and pesticides. Particulates can also cause corrosion of buildings, damage vegetation, and severely reduce visibility.

Since 1971, EPA has had a National Ambient Air Quality Standard for Total Suspended Particulates (TSP). This standard covers all kinds and sizes of particulates. Recent research suggests that smaller inhalable particulates present the most serious health threat as they tend to become lodged in the lungs and remain in the body for a long time. EPA is now in the process of replacing the present health standard with one aimed at these smaller particles.

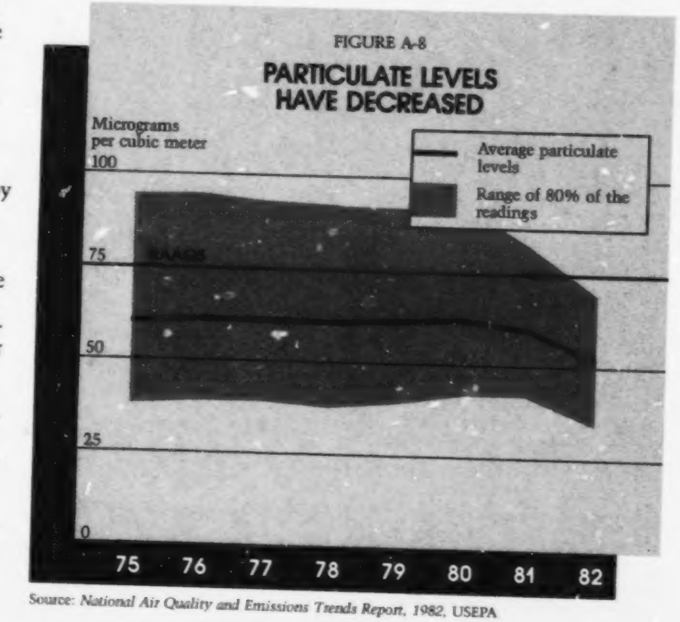
There are numerous sources of particulates, some of which may be controlled by conventional means and others which require more creative approaches. Major sources of particulates include steel mills, power plants, cotton gins, cement plants, smelters, and diesel engines. Other sources are grain storage elevators, industrial haul roads, construction work, and demolition. Wood-burning stoves and fireplaces can be a significant source of particulates in rural parts of the country. Urban areas are likely to have windblown dust from roads, parking lots, and construction activity.

EFFORTS TO DATE

EPA and States have sought to meet the standard by limiting emissions from industrial facilities and other sources. To meet emissions limits, industries have installed pollution controls such as electrically charged plates and huge

FIGURE A-8

PARTICULATE LEVELS HAVE DECREASED

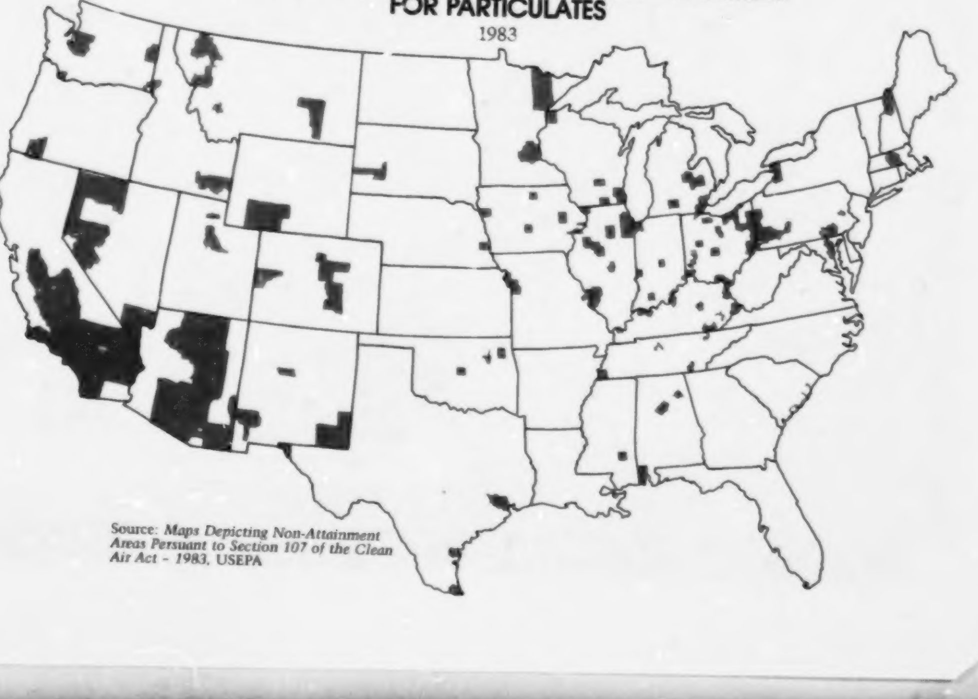


Source: *National Air Quality and Emissions Trends Report, 1982*, USEPA

FIGURE A-9

COUNTIES IN PARTIAL OR TOTAL NON-ATTAINMENT FOR PARTICULATES

1983



Source: *Maps Depicting Non-Attainment Areas Persuant to Section 107 of the Clean Air Act – 1983*, USEPA filters. EPA has also set emissions standards for diesel automobiles. Improved paving, better street cleaning, limits on agricultural and forest burning practices, and bans on backyard burning in urban areas are also helping to reduce particulate levels.

Such measures have reduced concentrations of dirt and contaminants in most areas; however, the TSP standards still have not been achieved in 345 areas (Figure A-9). For many of these areas, particularly in the western States, a major barrier to achieving the current standard is natural windblown dust.

EPA data show a 15 percent decrease in ambient particulate levels from 1975 to 1982, although some of this decrease reflects a change in the filters EPA used to monitor particulates (Figure A-8). During the same period, emissions dropped 27 percent nationwide. The difference in the emissions reductions and the ambient decreases reflects the impact of windblown dust from streets, construction sites, and natural sources.

PARTICULATES IN MISSOULA, MONTANA

Missoula, Montana, located in a valley in the Rocky Mountains, has suffered from air pollution since the 1800's. Missoula residents have had an especially difficult time controlling particulates. It now appears that despite compliance by industrial sources and successful street paving and cleaning programs, wood stoves are raising particulates to an unhealthy level.

As in many other parts of the country, fuel shortages and energy price increases since the early 1970's are forcing many Missoula households to seek less expensive ways of heating. Between 1977 and 1983, the use of wood for fuel among urban area households jumped over 44 percent, with slightly over 50 percent now using wood to some extent and 39 percent of residents using wood as a primary source of heat. This dramatic shift caused a major increase in particulate levels. Since 1980, wintertime particulate levels have routinely violated both health and environmental protection standards.

The people of Missoula now find themselves in a difficult situation. For years they have been encouraged to conserve energy and use less oil and gas. Wood stoves seemed to be the logical response. As a result, particulate levels are now so high that they could be a serious health threat. A recent study found that the lung capacity of the children of Missoula is lower than that of other Montana children.

This is just one example of how economic and environmental values can come into conflict. To make further progress in pollution control we must constantly balance such competing values and make decisions where the full consequences are rarely known.

TODAY'S CHALLENGES

Two of the greatest challenges we face are making the transition to the inhalable particulate standard and controlling new sources of particulates.

Inhalable Particulates

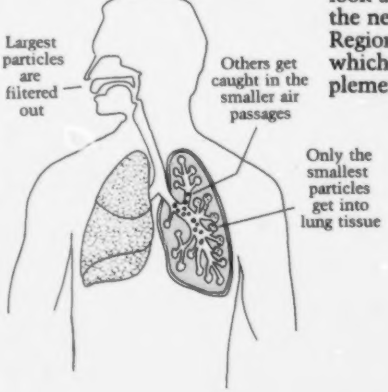
When EPA completes the revision of the existing standard to focus on smaller particulates, a number of areas now classified as "nonattainment" because of natural dust will meet the new standard. On the other hand, monitoring suggests that some areas that now attain the total particulate standard may not meet the new standard for inhalable particles.

Changing Energy Sources

Higher prices for oil and gas have led many homeowners to burn wood to heat their homes and factories and utilities to switch to coal. These trends toward greater wood and coal burning promise to increase particulate emissions substantially. Moreover, energy legislation allows facilities converting to coal to temporarily increase emissions until they install new control devices.

FIGURE A-10

ONLY SMALL PARTICLES ARE INHALED INTO LUNG TISSUE


Largest particles are filtered out
Others get caught in the smaller air passages
Only the smallest particles get into lung tissue

EPA'S AGENDA

EPA is continuing to enforce against sources violating the current particulate emission standards. At the same time, the Agency is expediting development of the revised standard, as well as the ambient monitoring and testing methods necessary to implement it.

After promulgation of the new standard, the Agency will help States modify existing ambient monitoring sites for these particulates. It will also issue guidelines for States to determine whether an area is in attainment under the new standard and, if not, how to achieve attainment.

The Agency will conduct studies to determine the principal sources of inhalable particulates and assess the effectiveness of traditional particulate matter control technologies in reducing emissions of small-sized particulates. It will also evaluate the impact of the size-specific standard on current New Source Performance Standards, identifying those which will need revisions.

By the end of 1984, an intragency work group will issue a report assessing research needs, regulatory alternatives, and potential problems brought about by the new standard. The work group will provide a detailed look at the ramifications of the new standard for EPA's Regional offices and States which are responsible for implementing and enforcing it.

Carbon Monoxide

THE PROBLEM

Carbon monoxide is an invisible, odorless product of the incomplete combustion of fuel. When inhaled, it replaces oxygen in the bloodstream and can impair vision, alertness, and other mental and physical capacities. It has particularly severe health effects for people with heart and lung problems.

The main source of carbon monoxide is motor vehicles, especially when their engines are burning fuel inefficiently, as they are when starting up in the morning, idling, or moving slowly in congested traffic. Other sources are fuel burning in homes, incinerators, and industrial processes. Although carbon monoxide levels have declined in most parts of the country since 1970, the standards are still exceeded in 151 cities and counties throughout the U.S. (Figure A-12). Many areas have local "hot spots" of carbon monoxide pollution, usually near heavily congested roadways and intersections.

Since 1968, the Federal Government has required that new cars be equipped with emissions controls. Further reductions in carbon monoxide in most places will depend on additional actions to ensure that these emission controls function as intended. Local "inspection and maintenance" programs are one way to police against disabling the control equipment by tampering with it or using leaded fuel.

EFFORTS TO DATE

National emission standards for motor vehicles, requiring reductions in carbon monoxide levels from 87 grams to 3.4 grams per mile, have been very successful in reducing the ambient levels of this pollutant. Ambient levels of carbon monoxide fell 31 percent between 1975 and 1982 (Figure A-11). An even greater improvement was seen in the number of exceedances of the ambient standard, which decreased 87 percent during this period.

Between 1975 and 1978 there was a 16 percent increase in car use which dampened the progress made by emissions controls. Since then, however, vehicle use has stabilized, making progress in emissions control more obvious. Many communities promoted mass transportation, ride sharing, fringe parking, and timed signal lights to improve traffic flow. State and local vehicle inspection and maintenance programs also helped reduce the carbon monoxide levels.

TODAY'S CHALLENGES

Three factors make it particularly difficult for some areas to attain acceptable levels of carbon monoxide.

The Growing Number of Automobiles

We expect additional emissions due to an increase in the total number of cars in use. In addition, older cars are not being replaced as rapidly as was expected, increasing the average age of cars on the road. Since older cars are generally the most serious polluters, this trend could have an impact on further progress for several years.

Inspection and maintenance programs are needed in some cities to combat air pollution.

Tampering and Fuel Switching

Because it is cheaper and has higher octane, some people have put leaded fuel in cars designed for unleaded. This destroys the catalytic converter, resulting in higher carbon monoxide emissions.

Delays in Implementing Inspection and Maintenance Programs

The public as a whole is not fully convinced of the need for, or effectiveness of, vehicle inspection and maintenance programs. Because of this, States have been slow to pass authorizing legislation and provide funds to operate such programs. These delays will undoubtedly continue to postpone attainment of the carbon monoxide standard in many places.

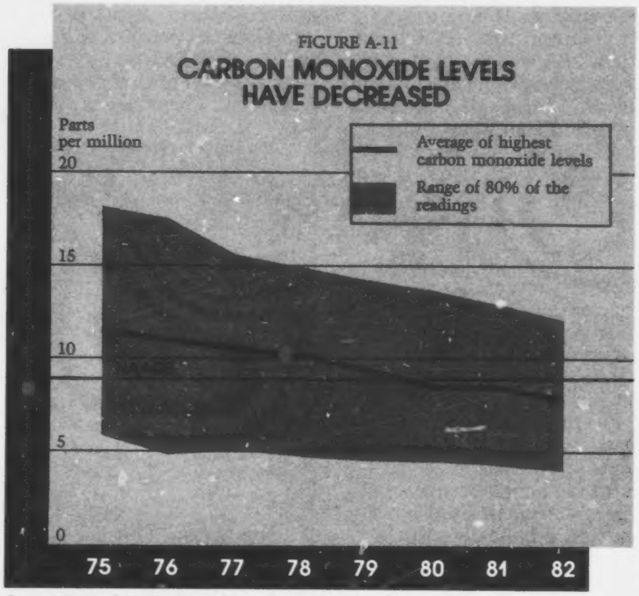


FIGURE A-11

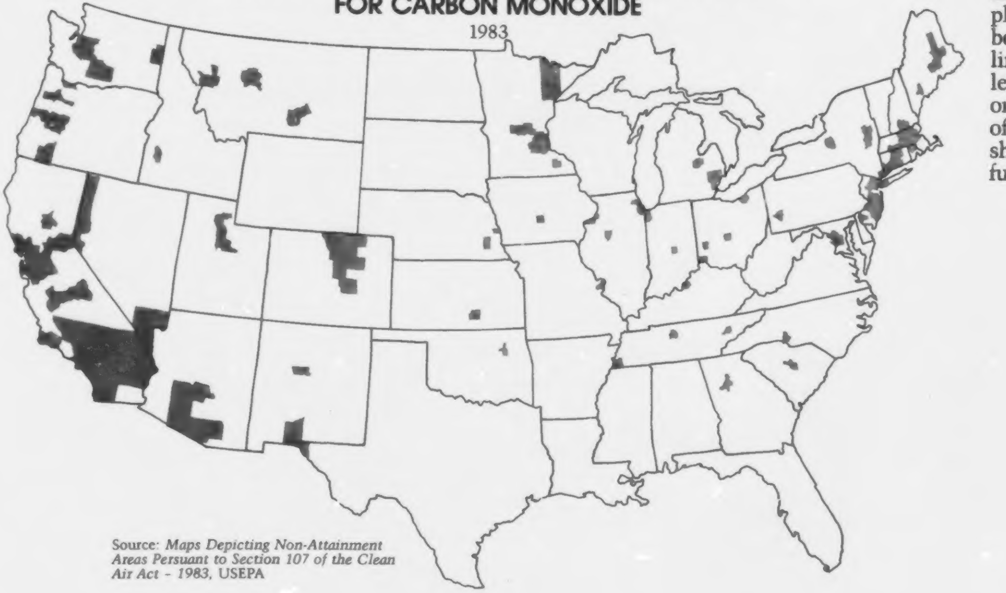
CARBON MONOXIDE LEVELS HAVE DECREASED

Source: *National Air Quality and Emissions Trends Report, 1982*, USEPA

FIGURE A-12

COUNTIES IN PARTIAL OR TOTAL NON-ATTAINMENT FOR CARBON MONOXIDE

1983


Source: *Maps Depicting Non-Attainment Areas Persuant to Section 107 of the Clean Air Act – 1983*, USEPA

EPA'S AGENDA

As required by the Clean Air Act, EPA is in the process of reassessing the carbon monoxide air quality standard and will reaffirm or modify the standard in 1984. EPA is also pressing States to carry out commitments (principally inspection and maintenance programs) to reduce carbon monoxide in the 97 counties where attainment is due by 1987. In 1985, EPA will analyze these State plans to see what additional steps, if any, will be needed to meet the deadline.

For the remaining areas where compliance was due by the end of 1982, EPA will work with States to correct the deficient implementation plans. Where States fail to take action, EPA will impose sanctions and additional controls as necessary.

EPA is also presently assessing several possibilities for eliminating or curtailing the use of leaded gasoline much earlier than originally planned. One of these would be a total ban of leaded gasoline. The other would be a leaded gas, but with about one-tenth the current amount of lead. Either of these options should solve most of the misfueling problems.

Sulfur Dioxide

THE PROBLEM

The ambient standard for sulfur dioxide is still exceeded in several areas of the country (Figure A-14). Excessive levels of this chemical in the ambient air have been associated with significant increases in acute and chronic respiratory diseases. In addition, sulfur dioxide bonds to particles of dust, smoke, or aerosols, and can be transported long distances in the atmosphere. The consequences of this, "acid deposition," are discussed as a separate issue.

Electric generating plants account for about 67 percent of total sulfur dioxide emissions. The proportion of sulfur dioxide from these plants is high partly because Federal energy policies since the oil shortage in the early 1970's have encouraged utilities to switch to more available fuels, including coal and "sour" oil containing relatively more sulfur. Other sources include refineries, pulp and paper mills, steel plants, smelters, and chemical plants (Figure A-15). Energy facilities related to oil shale, synfuels, and oil and gas production may also produce sulfur dioxide emissions. Home furnaces and coal burning stoves are sources that can more directly affect residential neighborhoods.

EFFORTS TO DATE

The problem of sulfur dioxide air pollution was well known when EPA was established in 1970; some States already had begun to limit sulfur dioxide emissions from power plants and factories. One of EPA's first actions was to set National Ambient Air Quality Standards for sulfur dioxide.

To meet the standard, State environmental authorities developed control plans for sulfur dioxide as varied as the industrial facilities whose emissions were being limited. Some mines and factories installed equipment to wash excessive sulfur from coal. Scrubbers and desulfurization equipment reduced emissions from other sources, principally utilities. Some of these facilities converted the sulfur emissions into commercial products such as sulfuric acid.

One technique used to attain the ambient standards may now prove to have been shortsighted. In response to growing energy problems, EPA and States sometimes allowed the use of tall stacks as an alternative to further reducing emissions. These stacks dispersed the gas and effectively reduced the local impact of sulfur dioxide from power and industrial plants. However, we now realize that emissions

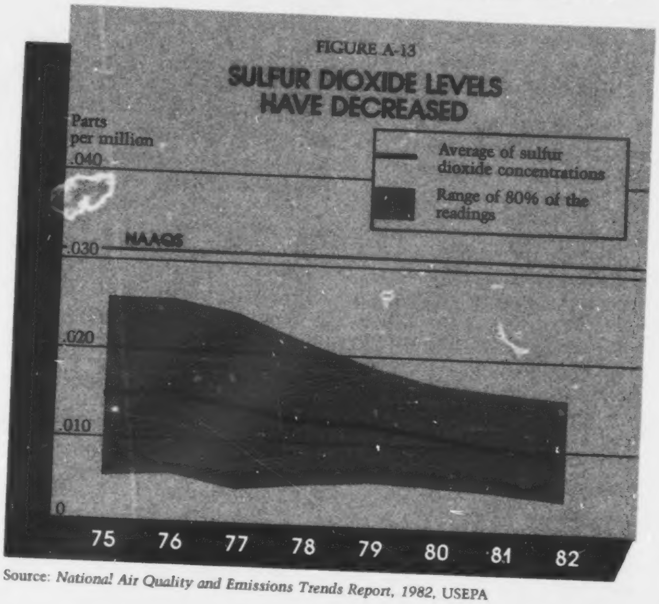
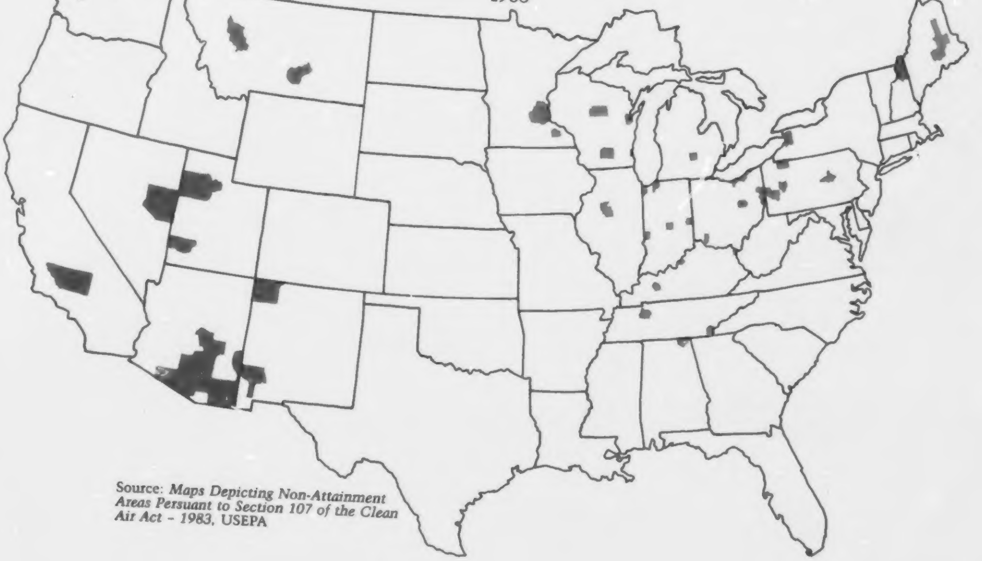


FIGURE A-13
SULFUR DIOXIDE LEVELS HAVE DECREASED

Source: *National Air Quality and Emissions Trends Report, 1982*, USEPA

FIGURE A-14
COUNTIES IN PARTIAL OR TOTAL NON-ATTAINMENT FOR SULFUR DIOXIDE
1983



Source: *Maps Depicting Non-Attainment Areas Persuant to Section 107 of the Clean Air Act – 1983*, USEPA from the tall stacks may be responsible for sulfuric acid deposition, with both local and distant impacts.

Overall the efforts to control sulfur dioxide have been quite successful. Ambient levels have fallen 33 percent between 1975 and 1982 (Figure A-13). The number of exceedances of the ambient standard dropped 91 percent during the same period. Emissions, however, have only decreased 17 percent. Differences between emissions and ambient trends reflect a shift in the use of high sulfur fuels from urban areas, where most of EPA's monitors are, to rural areas.

Since the ambient standards for sulfur dioxide were set, several issues have arisen. The geographical distribution of high-and-low sulfur coal, the economic impact on the mining and utilities industries of restrictions on high sulfur coal, and the variability of the sulfur content within coal have all engendered considerable debate.

State Requests

EPA has been requested by several States to relax sulfur dioxide emission limits in areas where the air is cleaner than required under the national standard for sulfur dioxide. Some of these actions would permit facilities to use less expensive and locally produced fuels. These requests have generated considerable debate within EPA because of the potential impact on acid deposition. While these changes may cause concern, as long as the ambient standards continue to be met EPA must approve them under the Clean Air Act.

Sulfur Content of Coal

The sulfur content of coal varies greatly according to where it is mined. The technical, political, and economic ramifications of this variance have complicated the task of setting sulfur dioxide limits for facilities burning coal.

EPA and the States have compliance programs to maintain air quality gains made so far and to improve the quality and usefulness of monitoring data for managing future efforts to control sulfur dioxide. EPA and the States will continue to enforce limits on sources affecting air quality in the areas where the national standard is violated.

EPA is near completion of its review of the national air quality standard for sulfur dioxide, as required by the Clean Air Act. If necessary, EPA will propose modification of the standard in 1984, with final action due in 1985. In that event, EPA will issue guidelines for States to change implementation plans.

EPA's policy with respect to emissions from tall stacks is currently being rewritten as the result of a judicial challenge. New regulations may require further tightening of current emission limits on existing sources, changing implementation plans in some States, and revising certain new source permits.

Performance standards for sulfur dioxide emissions from new or extensively modified industrial boilers are scheduled to be proposed in the Fall of 1985, although EPA is currently under litigation to issue these standards more quickly. The evaluation of the standard for new or modified utility boilers is just getting under way. EPA will continue to resolve formal petitions under the Clean Air Act involving interstate problems.

HOW A SCRUBBER WORKS

One way to reduce the amount of sulfur dioxide released into the air from the burning of fossil fuels, such as coal and oil, is through the use of "scrubbers." The process to remove sulfur dioxide, called flue gas desulfurization (FGD), typically uses water and lime and/or other materials to "scrub" pollutants from the exhaust gases.

In general, a scrubber consists of a chamber where the flue gas can come in contact with the lime or other chemicals used to react with the sulfur dioxide gas. In one method, water and lime are mixed together and sprayed into the chamber as droplets. Spraying the liquid in as droplets maximizes the surface area of the liquid that can come in contact with the flue gas. The sulfur dioxide and lime chemically combine to form a solid sulfate compound, thereby removing sulfur dioxide from the combustion gases. The "cleaned" exhaust gas is then released to the atmosphere. The solid residue is removed from the chamber usually as a wet sludge. Often the sulfur and other minerals are reclaimed before disposal of the sludge.

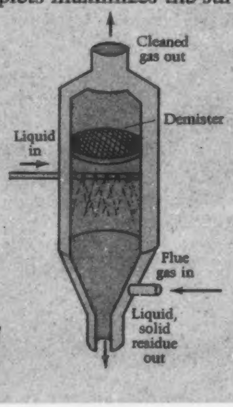
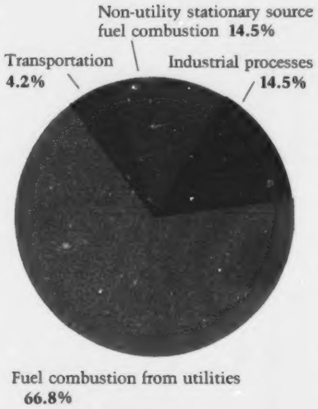


FIGURE A-15

UTILITIES ARE THE PRIMARY SOURCE OF SULFUR DIOXIDE EMISSIONS

1982



Source: *National Air Pollution Emission Estimates, 1940-1982*, USEPA

Airborne Lead

THE PROBLEM

Lead is a heavy metal that presents serious health and environmental threats. Lead can irreversibly damage the brain and kidneys and impair the circulatory and nervous systems. Once inhaled, approximately 25 to 50 percent is retained in the body. Fetuses and children under five are acutely sensitive to lead poisoning. Since their nervous systems are still developing, they risk brain damage and retardation if exposed to too much lead.

About 80 percent of the lead in the ambient air comes from leaded gasoline used in motor vehicles; the rest comes from stationary sources including lead smelters and battery plants. The lead problem is most severe near lead smelters.

EFFORTS TO DATE

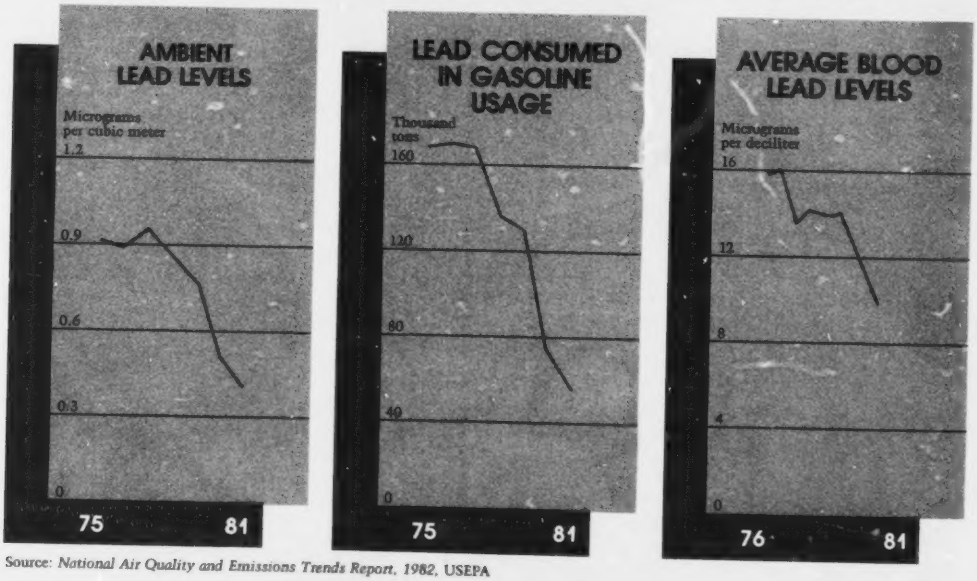
In the early 1970's, EPA required oil companies to reduce the amount of lead in gasoline. In 1975, when new cars with catalytic converters had to use unleaded gasoline, the use of leaded gasoline declined even more sharply.

As a result of the decreased use of leaded gasoline, violations of the air quality standard for lead have dropped. Overall, there was a 64 percent decrease in ambient levels between 1975 and 1982 (Figure A-17). A recent survey found that lead levels in the ambient air, gasoline, and blood dropped at similar rates (Figure A-16). Even so, exposure to lead is still a serious problem near lead smelters and in areas where use of leaded gasoline is still high.

Leaded
TOTAL SALE
0015
LITERS
PRICES BEING CHARGED FOR GASOLINE DO NOT EXCEED MAXIMUM ALLOWABLE PRICE
NOTICE
89
Regular

FIGURE A-16

LEAD IN THE AMBIENT AIR, GASOLINE AND BLOOD HAS DECLINED



Source: *National Air Quality and Emissions Trends Report, 1982,* USEPA

TODAY'S CHALLENGES

Further progress in reducing ambient levels of lead is complicated by several factors.

Continued Use of Older Cars

Because of a tighter economy and an increase in two-car families, the average age of U.S. cars has increased 25 percent since 1970, from 5.5 years to 6.9 years. Because most older cars were designed to operate with leaded gasoline, elimination of lead emissions from motor vehicles may be delayed.

Fuel Switching

The relatively high price of unleaded gasoline has caused a large number of motorists to use leaded gas in cars designed for unleaded. This not only increases lead emissions but also makes the catalytic converters, which are designed to clean up other criteria pollutants, ineffective.

Industrial Emissions

Most industrial emissions of lead are from smelting and processing. Many of these are old facilities where particles of lead escape easily through windows and walls rather than through smokestacks. These "fugative" emissions are hard to measure, monitor, and control.

State Support

In the belief that reductions in the use of leaded gasoline would achieve the ambient lead standard, some States delayed efforts to achieve compliance by lead facilities. A number of these States fell behind the Clean Air Act schedule for submitting plans to control these emissions. EPA is now implementing a schedule in conjunction with the States for the completion of these plans by the end of Fiscal Year 1985.

EPA'S AGENDA

EPA is developing reports on the health and environmental impacts of air pollution from lead as part of the required review of the current national standard for lead. Upon completion of the review, EPA will reaffirm or modify the standard, as required by the Clean Air Act. Final action is expected in 1986.

Settlement of litigation with the Natural Resource Defense Council over attainment of the lead standards calls for the completion and approval of overdue State Implementation Plans. Where States fail to develop the necessary plans, EPA will impose Federal plans including compliance schedules for sources whose emissions must be reduced to achieve the lead standards.

In addition, EPA's Air and Superfund programs will coordinate efforts to resolve emissions and lead dust problems around major smelters and lead facilities.

Finally, with EPA help, States are completing a 350-station network for monitoring ambient levels of lead in the air. States are also developing programs to prevent the illegal use of leaded gasoline in cars with catalytic converters.

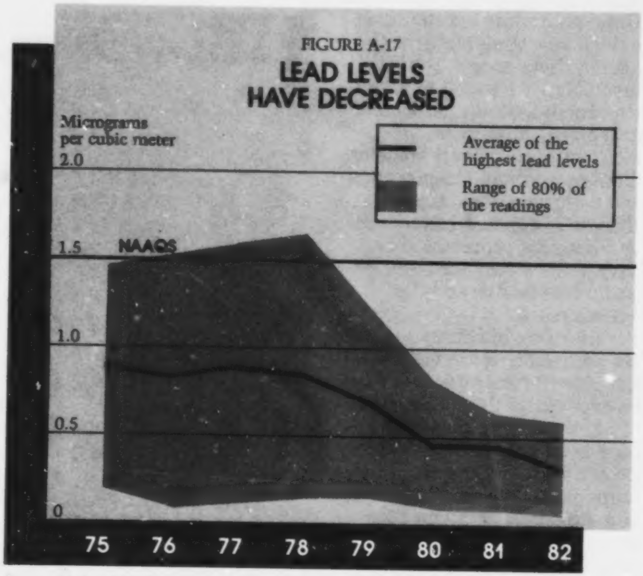


FIGURE A-17

LEAD LEVELS HAVE DECREASED

Source: *National Air Quality and Emissions Trends Report, 1982*, USEPA

Airborne Toxics

THE PROBLEM

Toxic pollutants are the most serious emerging problem the Agency faces today. Toxic substances are found in all environmental media. Attempts to remove them from one medium often merely transfer them to another. Despite their low concentrations, toxic chemicals emitted into the air by industrial processes may have serious long-term effects on human health and the environment.

Once toxic contaminants are emitted from a stack or tail pipe, for example, we may be exposed to them in a variety of ways. The most common is by inhalation. Indirect exposure may occur after airborne particles fall to earth and are taken up by crops, animals, or fish that we consume. These particles may also contaminate the water we drink. Through these routes, these substances accumulate over time to reach quite high concentrations in human fatty tissue and even breast milk.

Most information on the direct human health effects of airborne toxicants comes from studies of industrial workers. Exposure to these substances in the work place is generally much higher than in the ambient air. We know relatively little about the specific health and environmental effects of most of these substances at the low levels at which they are found in ambient air.

There are many possible sources which emit toxic chemicals into the atmosphere: industrial and manufacturing processes, solvent use, sewage treatment plants, hazardous waste handling and disposal sites, municipal waste sites, incinerators, and motor vehicles. Smelters, metal refiners, manufacturing processes, and stationary fuel combustion contribute toxic metals such as cadmium, copper, lead, arsenic, chromium, nickel, and silver. Toxic organics, such as vinyl chloride and benzene, are released by a variety of sources such as plastics manufacturing plants, chemical manufacturing, and gas stations. Chlorinated dioxins are emitted by some chemical processes and the high-temperature burning of plastics in incinerators.

Figure A-18 shows the levels of six volatile organic chemicals found in the ambient air near their sources and in urban and rural areas. Some of these compounds were found in urban areas at levels nearly equal to those found immediately around plant sites. All six compounds are now being assessed for possible future regulation.

SUEDE AND LEATHER
PLAZA CLEANERS
Rent The Rug Doctor
RENT ME HERE
LEATHER CARE
AUTHORIZED DEAL

Emissions from small stationary and mobile sources, such as dry cleaners and diesel trucks, make the control of toxics difficult.

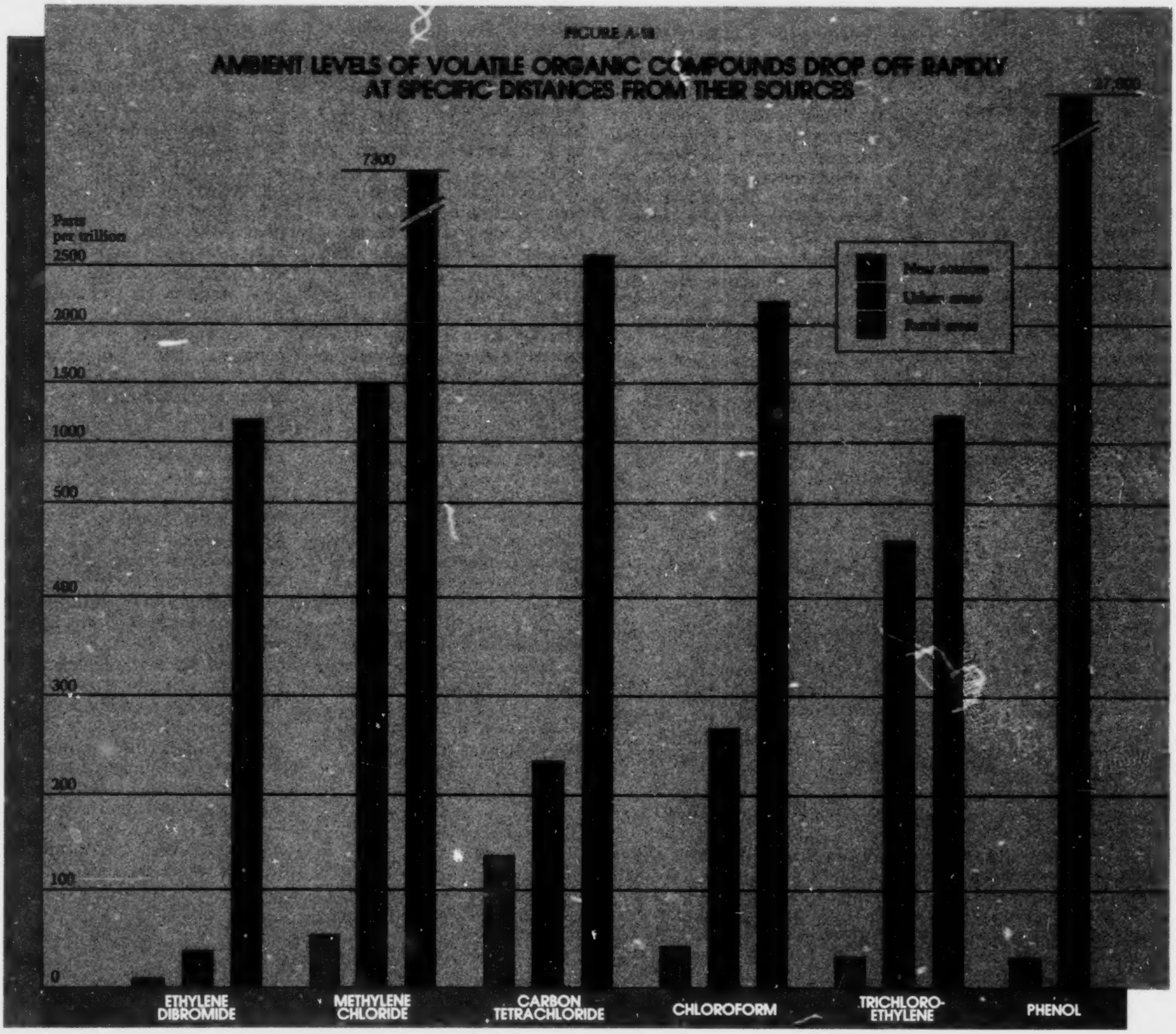


FIGURE A-18

AMBIENT LEVELS OF VOLATILE ORGANIC COMPOUNDS DROP OFF RAPIDLY AT SPECIFIC DISTANCES FROM THEIR SOURCES

Source: *Volatile Organic Chemicals in the Atmosphere: An Assessment of Available Date*, USEPA, 1982

EFFORTS TO DATE

EPA has issued National Emissions Standards for Hazardous Air Pollutants (NESHAPS) under the Clean Air Act for four hazardous air pollutants: asbestos, beryllium, mercury, and vinyl chloride. National emission standards for three more toxic pollutants, benzene, arsenic, and radionuclides, have been proposed, and EPA is assessing risks and control options on many additional chemicals.

Many State and local air agencies are developing their own programs for toxic pollutants. Some have addressed a large number of pollutants and, with EPA's help, are improving monitoring techniques to measure these pollutants in the environment. EPA also works with State or local agencies to investigate particular problems.

TODAY'S CHALLENGES

Risk Assessment

With improved scientific techniques, EPA can identify environmental contaminants at very low concentrations. Conducting a scientific assessment of the risk of these substances and deciding how to manage these risks usually involves very complex and controversial scientific and policy issues. For example, because of the number of assumptions involved, scientists often disagree over the risk assessment for a substance. Beyond this are additional issues concerning what exposures are acceptable from a health and environmental perspective and the social and economic costs and benefits of control.

Meaningful Involvement of the Public

EPA wants to be sure the public is informed about the issues and uncertainties in the risk management process and to involve interested and affected citizens in evaluating possible options to the greatest extent possible. Because of the highly technical nature of the issues, it is often difficult for citizens to participate without special effort on EPA's part.

More Potential Sources

Economic growth in the chemical industry during the next ten years is expected to outpace the average of all other industrial growth. This will probably mean more new plants in States where the chemical industry is already concentrated — California, Texas, and New Jersey. Without adequate control of emissions, this growth may increase the range and quantity of toxic substances released to the environment.

EPA'S AGENDA

One of EPA's highest priorities is to solve the growing national problem of air toxics. EPA intends to move aggressively under the Clean Air Act authorities and to assist State and local governments as they develop their own programs.

Specifically, EPA will continue to promulgate and enforce National Emission Standards for Hazardous Air Pollutants (NESHAPs) for significant sources of air toxics. By late 1985, EPA will decide whether 20 to 25 substances currently under review will require regulation as hazardous air pollutants. The Agency will be involving the public in these complex decisions through information workshops, hearings, and other means. Because the NESHAPs process is cumbersome and resource intensive, during 1984 EPA will evaluate alternative approaches to controlling air toxics.

In a related study, EPA will examine ways to improve its health and exposure assessments. Specifically, EPA intends to make better use of analytical tools such as pollutant dispersion modeling and analyses of the intermedia transfer of pollutants.

Another very high priority for EPA is to increase compliance with emission standards, especially with standards for volatile organic compounds (VOCs). EPA's recently developed Compliance Strategy for Stationary Sources of Air Pollution defines how EPA will work with States to improve industries' compliance. Bringing sources of volatile organic compounds into compliance should reduce both ozone levels and potential air toxics emissions.

EPA will also work to expand and improve long-term air toxics monitoring programs including those operated primarily by State and local agencies. This work will focus on consistent sampling and measurement techniques for toxic air pollutants. To ensure compatibility and ready access to data, EPA will develop criteria for monitoring networks and data handling systems that could be used by State and local programs as well.

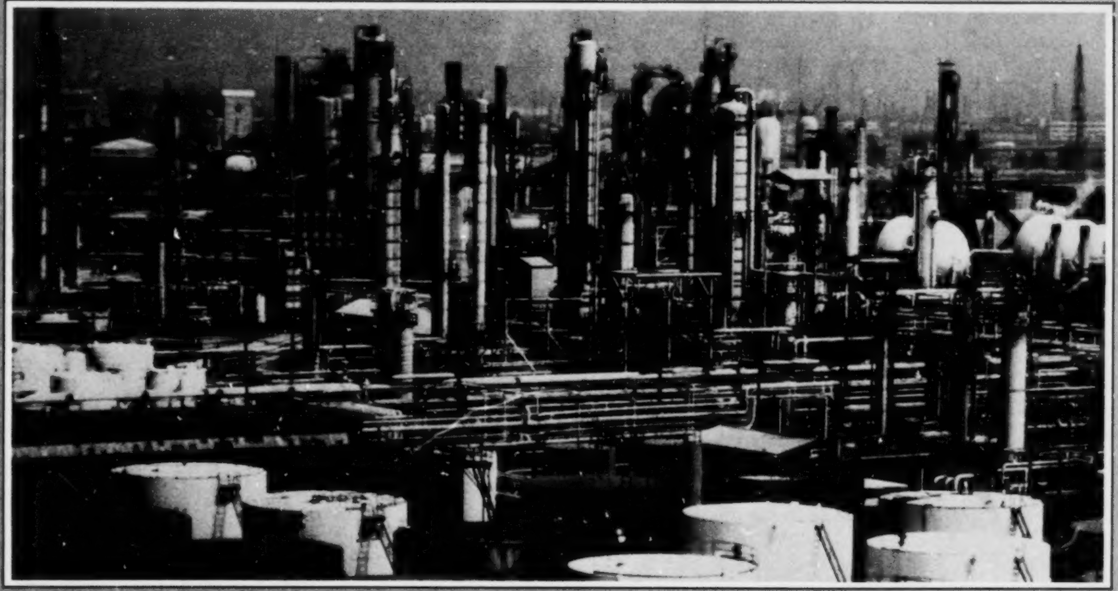
The Agency is trying to integrate its approach to toxics. We must coordinate our regulatory efforts and avoid inadvertently shifting problems from one medium to another or from one geographic location to another. An integrated approach is essential to managing cross-media toxic substances problems.

THE INTEGRATED ENVIRONMENTAL MANAGEMENT PROJECT IN PHILADELPHIA

EPA's Integrated Environmental Management Program (IEMP) is designed to assist environmental managers in providing workable, cost-effective strategies for addressing site-specific problems with toxics in all media. Philadelphia was selected as the IEMP's first project because of the city's diverse industrial base and its commitment to solving environmental problems.

The IEMP found that airborne toxic emissions in the city come principally from a dozen sources and that Philadelphia's sewage treatment plants are among the most important. This finding may have national significance. More industrial facilities are directing their waste discharges to municipal sewage treatment facilities. While this reduces the amount of waste directly discharged by industry, it increases the amount of waste sewage treatment plants must process. Volatile toxics, discharged by industry to the plants, enter the air during waste treatment. Sewage treatment plants are often overlooked as possible sources of air toxics pollutants. In addition, these sewage treatment plants are operated by the public sector. What level of government has responsibility for controlling air emissions from them is unclear.

In the future, the Philadelphia IEMP will: (1) trace pathways of toxic substances from the major industrial and municipal sources through the environment; (2) analyze the costs and benefits of controlling major sources, ranging from petroleum refineries to gas stations; (3) monitor toxic air emissions from sanitary landfills; and (4) conduct ambient monitoring for toxics in both air and water. Although the results are far from complete, the IEMP in Philadlephia offers interesting insights into both the nature of the potential air toxics problem and the most effective ways to reduce them.



Acid Deposition

THE PROBLEM

EPA and State environmental officials in many parts of the country report that acid deposition is a serious environmental concern now or is likely to be one in the future. Whether acid deposition presents a serious problem in a given area depends on two factors: the degree of acidity of the deposition itself and the ability of the land or water to neutralize it. Ohio, for example, has some of the most acidic (i.e., lowest pH value) precipitation in the country, but its soil also has a high ability to "buffer" it. New England soils, on the other hand, have very low buffering capacity (Figure A-19).

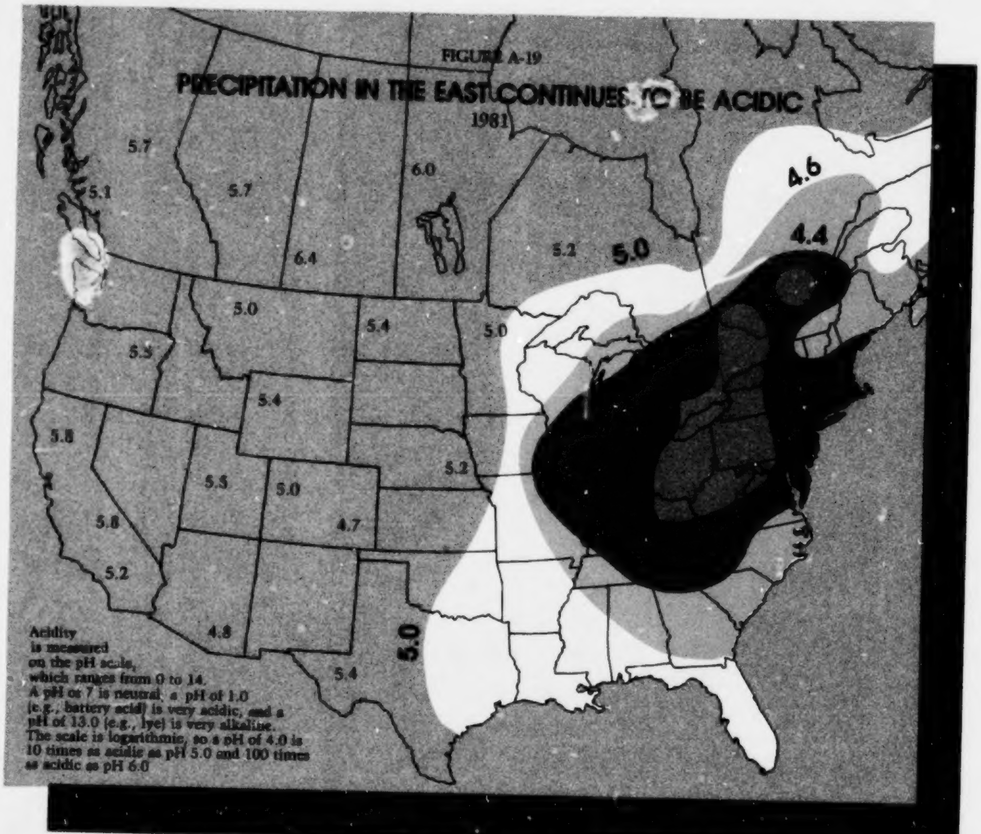


FIGURE A-19

PRECIPITATION IN THE EAST CONTINUES TO BE ACIDIC

1981

Acidity is measured on the pH scale, which ranges from 0 to 14. A pH of 7 is neutral, a pH of 1.0 (e.g., battery acid) is very acidic, and a pH of 13.0 (e.g., lye) is very alkaline. The scale is logarithmic, so a pH of 4.0 is 10 times as acidic as pH 5.0 and 100 times as acidic as pH 6.0

Source: The National Atmospheric Deposition Program and the Canadian Network for Sampling Precipitation

Surface waters, soils, and bedrock which have a relatively low buffering capacity are unable to neutralize the acid effectively. Under such conditions, the deposition may increase the acidity of water, reducing much or all of its ability to sustain aquatic life. Forests and agriculture may be vulnerable because acid deposition can leach nutrients from the ground, kill nitrogen-fixing microorganisms that nourish plants, and release toxic metals.

The process of acid deposition begins with emissions of sulfur and nitrogen oxide gases which interact with sunlight and water vapor in the upper atmosphere to form acidic compounds. During a storm, they fall to earth as acid rain or snow. Alternatively, they may join dust or other dry airborne particles and fall as "dry deposition." When pollutants are emitted through tall stacks, they rise high into the atmosphere and form acids which may fall in the immediate area or stay airborne for a long time, travelling hundreds of miles across county, State, and even national boundaries.

In the East, the majority of the acidity in precipitation is from sulfur dioxides. In the West, a greater proportion is from nitrogen dioxides. Sulfur dioxide is primarily the result of the burning of fossil fuel. High-temperature burning from both stationary and mobile sources produces nitrogen oxides. Ozone and other oxidants also may encourage the formation of acidic materials.

Acid deposition is believed to pose little direct risk to human health. Although the inhalation of acid fog may present some health threat, the typical acidity of acid rain can be well tolerated by human skin and intestinal tracts.

EFFORTS TO DATE

Acid deposition involves a number of air contaminants already regulated by EPA and the States under the Clean Air Act. However, acid deposition can occur even when current clean air standards and emission limits are met. The problem poses extremely difficult scientific, economic, and political issues.

Federal research activities on the effects and extent of acid deposition are coordinated by the National Acid Precipitation Assessment Program initiated in 1980. This program incorporates the Federal Interagency Task Force on Acid Precipitation, Northeast Acid Rain Task Force, and the cooperative Southern Blue Ridge Province Study. Working with the Tennessee Valley Authority, the Blue Ridge study is particularly interested in the effects of acid rain in warm climates.

EPA and other scientists are reviewing data from monitoring networks such as the Great Lakes Air Deposition study and the National Atmospheric Deposition Program. The National Academy of Sciences is reviewing the acidification of surface waters and will recommend additional research to understand this process.

An interagency research program is working on the problem of damage to our forests. EPA is sponsoring joint meetings and field observations by European and American scientists to develop and test hypotheses to explain the mechanisms of forest damage.

EPA is initiating field tracer studies to understand the complex meteorology of long distance pollutant transport. Efforts are also under way to characterize the complicated sequence of chemical reactions by which sulfates, nitrates, oxidants, and other pollutants are formed in the atmosphere. Improved understanding of meteorology and chemistry and more sophisticated atmospheric models will help EPA assess alternative control strategies.

Congress has also been wrestling with the acid deposition issue. Proposed approaches range from intensified research to requiring certain industries, most notably electrical utilities, to reduce sulfur dioxide and nitrogen dioxide emissions by as much as 12 million tons a year nationwide.

Tall stacks disperse Sulfur Dioxide high into the air.

TODAY'S CHALLENGES

The level of scientific and economic uncertainty concerning acid deposition must be reduced before we can make sound public policy decisions.

Scientific Uncertainty

Any acid deposition control program will represent a major environmental, economic, and social investment for this country. Knowledge of how and where to target that program, how big to make it, and what to expect from it will be crucial to assure that our investment is wisely made.

Cost of Controls

Any control program will be costly. Before large sums of money are committed to controls, we should have as clear a picture as possible of what we are getting for this investment. Our research program under the National Acid Precipitation Act is aimed at closing the gaps in our understanding.

Regional and International Conflicts

This issue has been and remains a most divisive one. More than any other pollution problem, acid rain has the potential for dividing us along regional and international lines. To solve it, we must all approach the problem with goodwill and a recognition of the legitimate concerns of people in every section of this country and Canada.

EPA'S AGENDA

The Administration is requesting a total of $127 million in Fiscal Year 1985 to deal with acid rain. Of this, $55.5 million will go to an interagency research effort administered by EPA, the Department of Agriculture, and National Oceanic and the Atmospheric Administration. The balance will go to research on control technology and ways to reduce the damage caused by acid deposition.

Planning has been completed for a survey of some two to three thousand lakes in sensitive areas. This National Lakes Survey will begin in the Fall of 1984 and provide information on the extent of acid rain damage in lakes and watersheds.

A national trends network to monitor wet deposition will be expanded in the next few years. We are also developing a monitoring network for dry deposition. These efforts should give us a much better idea of the nature and extent of total deposition and eventually reveal long-term deposition trends.

The Interagency Task Force plans to produce formal reports based on the acid deposition research program in 1985, 1987, and 1989. Knowledge of the deposition problem will increase our ability to determine the need for and select effective controls.

WATER

Preceding page blank

WATER

When EPA was established in 1970, the Nation was painfully aware of water pollution. For example:

- The Izaak Walton League described the Willamette River in Oregon as a "stinking slimy mess, a menace to public health, aesthetically offensive, and a biological cesspool."
- In the Nation's capital, huge mats of smelly, floating algae clogged the Potomac River.
- Escambia Bay, East Bay, Pensacola Bay, and Santa Rosa Sound, Florida, were so polluted that fish kills were measured in terms of square miles of dead fish.

During the years since Earth Day, individual citizens, businesses, industries, and governments have achieved important successes in restoring water quality. Sport fishermen again line the banks of the Willamette, the Potomac has raft races, fishing derbies, and waterfront festivals, and rather than square miles of dead fish, shrimp and oysters are back in Pensacola Bay. Yet, in contrast to the many dramatic water quality successes, many of our Nation's lakes and streams are still too polluted for fishing or swimming.

This chapter begins with an overview of the Nation's approach to controlling water pollution and describes the progress achieved so far. The rest of the chapter is about the six most significant problems facing the Nation's waters and EPA's plans to address those problems.

Pages 38. 39, and 40
are blank.

AN OVERVIEW

The Environmental Protection Agency, in partnership with State and local governments, has responsibility for water quality in three areas. The first is reducing pollution of *surface waters*, i.e., rivers, lakes, streams, coastal waters, oceans, and sensitive areas such as wetlands and estuaries. The second is preventing contamination of *ground waters*, i.e., underground formations of saturated rock and sand. The third is maintaining the purity of *drinking water*, i.e., the surface and ground waters needed for human consumption.

Congress has given EPA and the States broad authority to deal with toxic and conventional water pollution. The principal law is the Clean Water Act (CWA). In 1972, the CWA set as a goal "the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters." The law mandated a variety of new programs to reduce the volume of pollutants entering surface waters. Congress also set an interim goal of achieving, where possible, water suitable for fishing and swimming.

To protect the marine environment from the harmful effects of ocean disposal, Congress passed the Marine Protection, Research, and Sanctuaries Act. The Act established a program to ensure that ocean disposal is conducted according to carefully drawn environmental criteria.

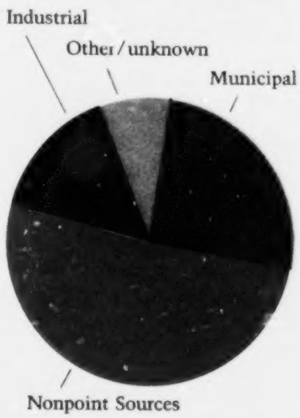
No Federal law directly addresses ground-water quality or establishes objectives or goals for managing ground water or the contaminants that can pollute it. Several Federal laws, however, cover specific sources of ground-water contamination. These include:

- The Safe Drinking Water Act to protect underground sources of drinking water from fluids injected into the ground.
- The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (known as CERCLA or "Superfund") to prevent ground-water contamination from active and abandoned hazardous waste facilities.
- The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to control the production and use of agricultural and other pest control chemicals.
- The Toxic Substances Control Act (TSCA) to review new chemicals before they are introduced into commerce and control the public health and environmental risks of existing chemicals.

FIGURE W-1

MAJOR CAUSES OF STREAM POLLUTION

(for 200,000 miles of streams not meeting their designated uses)



Source: *America's Clean Water*, Association of State and Interstate Water Pollution Control Administrators, 1984

EPA's approach to the problem of contaminated drinking water focuses on providing safe water to users of public water systems. Under the Safe Drinking Water Act (SDWA), EPA sets national standards for drinking water and requires routine monitoring to ensure that drinking water is free of harmful levels of contaminants.

For this report we divide the pollutants that affect these waters into two major groups: "toxic" and "conventional" pollutants.

- **Toxic substances** include heavy metals, such as mercury and lead, and organic chemicals, such as PCBs, solvents, and pesticides. Many toxic substances do not break down readily in the environment and, once released, are very difficult if not impossible to control. Toxic substances produce a variety of serious human and environmental problems, even when present in water in very small amounts. Control of toxic pollutants is an expensive, complex, and highly controversial problem.

THE TOOLS OF THE CLEAN WATER ACT

Recognizing the challenge and complexity of meeting the "fishable/swimmable" goals of the Clean Water Act, Congress established a variety of tools for EPA and the States. These break down into six major programs.

Planning

The States receive planning grants from EPA to review local water pollution problems and define methods for solving these problems. These include planning for the control of sources of pollution, such as nonpoint runoff.

Standards Development

The States adopt water quality standards for their streams. These standards define a use for the stream, e.g., trout fishing, and prescribe water quality criteria to achieve that use.

Effluent Standards

The EPA develops limits on how much of a pollutant may be discharged by industries and municipalities into our Nation's waters. These limits are developed at a national level based on engineering and economic judgments. EPA or the State is required to make the discharge limits for an individual plant more stringent if necessary to meet the State water quality standards.

Grants

The Act directs EPA to provide financial assistance to States to support State water programs such as the construction of municipal sewage treatment plants, permitting, water quality monitoring, and enforcement.

Dredge and Fill Program

EPA develops environmental guidelines for the protection of wetlands from dredging and filling activities. These guidelines are used to assess whether or not permits should be issued for filling activities.

Permits and Enforcement

All industries and municipal dischargers receive permits from either EPA or the States. EPA and the States regularly inspect these dischargers to determine whether a source is out of compliance with its permit and take appropriate enforcement actions as needed.

- **Conventional pollutants** include organic waste, sediment, acid, bacteria and viruses, nutrients, oil and grease, and heat. The effects of these pollutants vary. In high concentrations, some of these are also "toxic." Some, such as organic wastes and nutrients, consume dissolved oxygen, making water unsuitable for fish. Others, such as sediment and oil and grease, cloud the water, choke fish gills, and smother bottom habitats and egg deposits. Bacteria and viruses can become serious threats to public health.

One of EPA's key jobs to control these pollutants is to prepare "criteria documents" to set water quality standards. A criteria document sets forth what amounts of a pollutant are safe for human health and aquatic life based on the latest scientific information. States use them to establish the necessary water quality standards, e.g. the criteria that a stream must meet in order to support its desired use. For example, Vermont wants a stream to meet the "use" of a spawning areas for brook trout, salmon, rainbow trout, and brown trout. The dissolved oxygen criteria document prescribes that seven milligrams per liter of dissolved oxygen must be present for a "cold water fishery/spawning area," the appropriate use designation for these type of fish. Together the use and criteria are the water quality standard. These water quality standards are used to determine whether current controls are protecting water quality and serve as a benchmark to determine what level of additional controls are needed.

SOURCES OF THE PROBLEM AND EPA'S APPROACH

The job of cleaning and protecting the Nation's water is made complex by the variety of sources of pollution. In general, water quality problems are caused by one of four major categories of pollution sources: municipal, industrial, nonpoint, and dredge and fill activities (Figure W-1). Occasionally a stream or groundwater aquifer is affected by only one of these sources. More often, it is a combination of these sources that pollute streams, lakes, coastal areas, or ground water.

Municipal

Municipal wastewater primarily consists of water from toilets and "gray water" from sinks, showers, and other uses. This wastewater which runs through city sewers may be contaminated by organic materials, nutrients, sediment, bacteria, and viruses. Toxic substances used in the home, including crankcase oil, paint, household cleaners, and pesticides, also make their way into sewers. In many towns, industrial facilities are hooked into the municipal system and frequently discharge toxic metals and organic chemicals into the systems. Sewage is sometimes combined with storm water from downspouts, streets, and parking lots.

Municipal pollution can be controlled by properly constructed and maintained household systems and, where necessary, by the construction and operation of sewage treatment plants. Toxics discharged by industry are controlled by "pretreating" industrial wastes before they are discharged into municipal sewers. The Clean Water Act mandated a program of Federal grants to share the cost of sewage treatment plant construction with States and local governments.

The CWA also established a program to issue permits to every facility that discharges waste into water, including all sewage plants. The permits, under the National Pollution Discharge Elimination System or NPDES, establish the amount of each pollutant that the plant may discharge based on national effluent limits or, where necessary, the quality of the water. (See highlight on NPDES.)

A by-product of these water pollution controls is sludge, a dense, mudlike material made up of the pollutants removed from the water and the bacteria used in the treatment process. Appropriate disposal of sludge is a serious problem for many cities. (See section on Municipal Sludge.)

Industrial Sources

The use of water in industrial processes, such as the manufacturing of steel or chemicals, produces billions of gallons of wastewater daily. Some industrial pollutants are similar to those in municipal sewage but often more concentrated. Others are more exotic and include a great variety of heavy metals and synthetic organic substances. In large enough dosages, these pollutants may present serious hazards to human health and aquatic organisms.

Industrial water pollution control also relies mainly on enforcing NPDES permits. Many industrial permits are now being revised in a "second round" of permits to better control toxic substances in their discharges.

Nonpoint Sources

"Nonpoint sources" refer to multiple, diffuse sources of pollution as opposed to a single "point" source such as a discharge pipe from a factory. For example, rainwater washing over farmlands and carrying top soil and chemical residues into nearby streams is a major nonpoint source. The primary nonpoint sources of pollution include water runoff from urban areas and from farming, forestry, mining, and construction activities.

By volume, the major pollutant from nonpoint sources is sediment. Runoff may also carry oil and gasoline, agricultural chemicals, nutrients, heavy metals, and other toxic substances, as well as bacteria, viruses, and oxygen-demanding nutrients.

Due to the variety, scope, and complexity of water pollution from point and nonpoint sources, Congress authorized EPA to award grants

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

What Is a NPDES Permit?

Under the Clean Water Act, the discharge of pollutants into the waters of the United States is prohibited unless a permit is issued by EPA or a State under the National Pollutant Discharge Elimination System (NPDES). These permits must be renewed at least once every five years. There are approximately 49,800 industrial and 15,600 municipal facilities that currently have NPDES permits.

What Do NPDES Permits Contain?

A NPDES permit contains effluent limitations and monitoring and reporting requirements. Effluent limitations are restrictions on the amount of specific pollutants that a facility can discharge into a stream, river or harbor. Monitoring and reporting requirements are specific instructions on how frequently to sample the effluent to check whether the effluent limitations are being met. The permittee may be required to monitor the effluent on a daily, weekly, or monthly basis. The monitoring results are then regularly reported to the EPA and State authorities. When a discharger fails to comply with the effluent limitations and monitoring and reporting requirements, EPA or the State may take enforcement action.

How Are These Effluent Limitations Developed?

Congress recognized that it would be an overwhelming task for EPA to establish effluent limitations for each individual industrial and municipal discharger. Therefore, Congress authorized the Agency to develop uniform effluent limitations for each category of point sources such as steel mills, paper mills, and pesticide manufacturers. The Agency develops these effluent limitations on the basis of many factors, most notably efficient treatment technologies. Once EPA proposes an effluent limit and public comments are received, EPA or the States give all point sources within that industry category NPDES permits using the technology-based limits. Sewage treatment plants are also provided with effluent limitations based on technology performance.

What Are Water Quality-Based Limits?

Sometimes more stringent limitations than technology-based limits are necessary to make waters safe for fishing or swimming. For example, there may be several different facilities discharging into one stream, creating pollutant levels harmful to fish. In this case, the facilities on that stream must meet more stringent treatment requirements, known as water quality-based limitations. The permits are written to better control the pollutants covered by each facility's NPDES permit.

for State and local programs to develop water quality management (WQM) plans. These plans identify water pollution problems and the appropriate control programs including controls for nonpoint sources. EPA has approved over 200 State and local WQM plans. State and local governments, along with EPA, now are refining and updating these plans to meet our water quality goals.

Dredge and Fill Activities

When waterways are dredged to make them wider or deeper, the dredging churns up bottom sediments and other pollutants, such as PCBs and heavy metals, which are bound to the sediments. These resuspended pollutants thus get a new chance to pollute the environment. Moreover, when dredged materials are dumped onshore, they can seriously harm sensitive wetland areas such as swamps, bogs, and coastal marshes.

The Federal program to regulate the discharge of dredge or fill material in United States waters is jointly administered by EPA and the U.S. Army Corps of Engineers. In this program, EPA encourages careful consideration of alternative sites and methods to mitigate the effects of dredged or fill material on wetlands or open waters.

PARTNERSHIP IN ACTION ON THE CHESAPEAKE BAY

The Chesapeake Bay is one of the most vivid examples in the country of the need for partnership in dealing with environmental problems.

Millions of people have a stake in the future of the Bay. A focus for much of the region's industry and a prime recreational and aesthetic resource, the Bay has undergone degradation from both point and nonpoint sources of pollution. The nonpoint sources, such as sediment and chemical run-offs from farms and discharges from storm drains, are the key problems. They are proving far less amenable to control than municipal and industrial point sources.

Nutrient levels have increased in many areas of the Bay, causing algal blooms in some parts. The amount of Bay water exhibiting low or no dissolved oxygen has increased by a factor of 15 over the past 30 years. Heavy metals and toxic organic compounds have been detected at elevated levels in both the water and sediments. Evidence of the bioaccumulation of some of these toxic contaminants has also been observed. Harvests of shellfish and freshwater spawning fish have declined. Submerged aquatic vegetation has decreased throughout the Bay, and the diversity and abundance of benthic organisms have declined as a result of the polluted waters.

On December 9, 1983, the EPA joined with the State of Maryland, the Commonwealths of Pennsylvania and Virginia, and the District of Columbia in issuing an agreement recognizing the Bay's water quality problems and setting four major goals to restore the long term vitality of this national resource. These goals are to (1) improve and protect the water quality and living resources of the Bay system; (2) accommodate growth in an environmentally sound manner; (3) assure a continuing process of public input and participation on regional issues by Bay management; and (4) support and enhance a regional cooperative approach toward Bay management. EPA has placed a high priority on action to preserve the Bay and will provide a central forum for the plan to spend $40 million in Federal funds over the next four years to restore the Bay. Ten million dollars has been approved for next year; the majority of that money will be spent to control nonpoint sources.

The concerted efforts of cities, States, the Federal government, and everyone who works on or enjoys the Bay will ensure the restoration and preservation of this unique national resource.

PROGRESS TO DATE

Overall, the national strategy to restore and maintain water quality is working. EPA and States' actions are reducing the volume of pollutants going into the Nation's waters. As a result, many streams, lakes, and rivers have shown dramatic improvements. In spite of these accomplishments, however, the goals of restoring and maintaining water quality for fishing and swimming are still not met in many bodies of water. Furthermore, the quality of ground water and extent of toxics pollution remain largely unknown.

Surface Waters

Clean Water Act programs have generally been effective in reducing the volume of pollutants entering the Nation's waters.

- Industrial pollution has been reduced significantly since 1972. Biochemical oxygen demand (BOD), the measure of organic materials that deplete the dissolved oxygen in water, has decreased 71 percent. Total suspended solids, such as soil particles, dropped 80 percent; dissolved solids, 52 percent. Oil and grease fell 71 percent; phosphate, 74 percent; and heavy metals, 78 percent.

- Municipal sewage treatment plants now remove 13,600 tons a day of suspended solids and BOD, an increase of 65 percent from 1973 levels. The Clean Water Act requires that most publicly owned sewage treatment plants meet "secondary treatment" levels, i.e., remove at least 85 percent of several key pollutants or whatever level is necessary to meet the local water quality standard. In July 1977, 37 percent of the plants which were needed in 1972 in order to meet this goal had been built; by June 1983 that figure almost doubled, to 69 percent.

- In the last decade, the population served by sewers grew by 18 million and the average water flow increased by almost 7 billion gallons a day. Because of better treatment methods, the amount of pollution discharged into the water from sewage treatment plants has stayed about the same in spite of this increased demand.

- Pollution control equipment designed to remove conventional pollutants does a better than expected job of removing toxics, especially toxic metals. The construction of sewage treatment plants and industrial controls has markedly helped reduce the amount of toxic pollutants discharged into water.

The best measure of progress, however, is how well we have achieved the water quality goals of the law. State and Federal data indicate that our water pollution efforts have made significant headway to restore or protect water quality.

In 1983, the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), under a cooperative agreement with EPA, worked with the States to assess progress in protecting surface waters. The States looked at the 354,000 miles of rivers for which they had water quality information for the entire decade since 1972. They reported that 47,000 miles of streams got better, 11,000 miles got worse, and 296,000 miles stayed about the same. Similar trends were noted for lakes and estuaries.

Another way to assess water quality is to look at the extent to which waters support their intended use, e.g., swimming, sport fishing, or a drinking water source. Over 99 percent of the streams nationwide are designated for water uses equal to or better than the "fishable/swimmable" goal mandated by Congress. The States reported that, of the 758,000 miles of rivers assessed in 1982, uses were supported on 488,000 miles, partially supported on 167,000 miles (i.e., some water quality standards are met), and not supported on 35,000 miles. The status of 68,000 miles is unknown.

The States' conclusion that the water quality of most water bodies has stayed the same or improved corroborates a study undertaken in 1982 to assess the biological health of the Nation's rivers and streams. In this study the U.S. Fish and Wildlife Service and EPA asked State fish and game officials to estimate the health and diversity of fish in each of 1,300 statistically selected streams. Each of the selected streams was ranked on a relative scale from zero, for inability to support any fish, to five, for the maximum ability to support desirable fish species. The health and diversity of the fish community is considered to be a good yardstick of the overall health of a stream, i.e., it indicates whether it meets the "fishable" goal of the Clean Water Act.

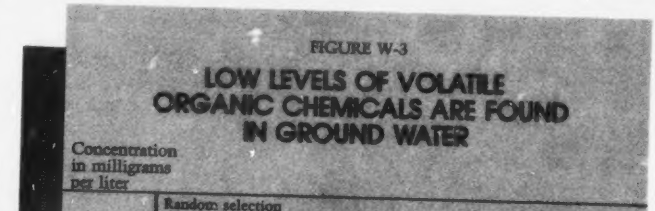
The survey found that 67 percent of the Nation's waters have at least a minimum ability to support sport fish or other fish species of special concern. Many of the remaining streams which cannot support fish do not flow year-round and, therefore, are not likely to be improvable. The survey further shows that the ability of the Nation's waters to support sport fish populations has not changed much over the past five years. In 91 percent of waters, this ability has not appreciably changed; in 5 percent of waters it had deteriorated, and in 4 percent it had improved (Figure W-2).

Water quality was found to affect the fish community adversely in 56 percent of the Nation's waters. Overall, nonpoint sources were found to affect 38 percent of all waters and are ranked as major concerns in 19 percent of waters. Municipal and industrial point source dischargers are located on, or have potential to affect, only about 20 percent of the Nation's rivers and streams. However, the survey found that over 10 percent of all waters are adversely affected by point sources, and that in 5 percent of all waters, point sources are ranked as major concerns.

Most of the available water quality information relates to water pollution from conventional pollutants. However, in the ASIWPCA study, officials from 39 States provided additional information

FIGURE W-3

LOW LEVELS OF VOLATILE ORGANIC CHEMICALS ARE FOUND IN GROUND WATER



Source: "Ground Water Supply Survey, Summary of Volatile Organic Chemical Data," EPA's Office of Drinking Water, January, 1983

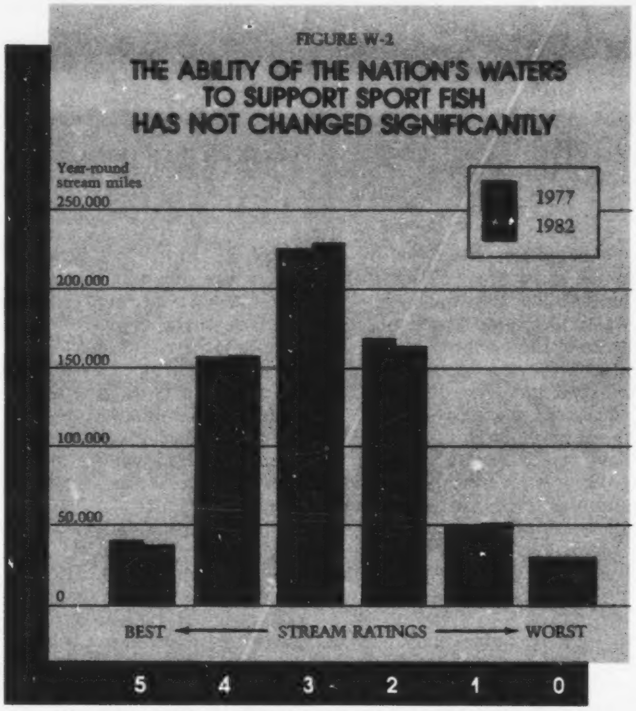


FIGURE W-2

THE ABILITY OF THE NATION'S WATERS TO SUPPORT SPORT FISH HAS NOT CHANGED SIGNIFICANTLY

Source: *National Fisheries Survey*, EPA and the U.S. Fish and Wildlife Service, 1984

on the effects of toxics on surface water. They reported that 14,000 miles of streams, 638,000 acres of lakes, and 920 acres of estuaries have known toxic pollution problems. The National Fisheries Survey found that the fish community in approximately ten percent of all waters were affected by toxics.

Ground Water

While most ground water appears to be of good quality, contamination has been found in many places from Maine to California. Several factors have focused our attention on ground-water quality:

- Many towns and businesses, particularly farms, are using more ground water to supplement surface water supplies, particularly in dry spells.
- Ground water is now the source of drinking water for about half of all Americans. It is the sole source for many communities, especially in rural areas.
- There has been a significant increase in well closings due to toxic contamination.

EPA's understanding of the sources and dimension of the threat to ground water is limited, but increasing. For example, EPA recently surveyed volatile organic chemicals (VOCs) in public water systems which are dependent on ground water. VOCs are manmade and are not found naturally in water. Although the concentrations detected were generally very low, the extent of contamination was greater than anticipated. Detectable levels of volatile organic chemicals were found in 20 percent of the small public water systems (less than 10,000 users) and 28 percent of larger systems (more than 10,000 users) (Figure W-3). While low levels of volatile organic chemicals in ground water do not definitely indicate a health hazard, some of these chemicals are highly toxic and may be carcinogenic.

Drinking Water

When the Safe Drinking Water Act became law, there was public uncertainty not only about chemical purity but also about who provided drinking water and who was responsible for its purity. The Federal Government had reliable water quality information on only about 19,200 community water systems in 1969. Today more than 59,000 systems are known to provide water on a daily basis.

More importantly, the number of systems meeting monitoring requirements and water quality standards has risen steadily. In 1969, only 15 percent of community systems were believed to routinely monitor drinking water for bacteria that may cause disease. By 1982, 70 percent were doing regular bacteriological analyses *and* meeting the national standard for bacteriological contamination.

TODAY'S WATER POLLUTION CHALLENGES

In the 1970's, EPA sought to control major sources of "conventional" pollutants, primarily from large point sources such as industries and municipal sewage treatment plants. Much progress has been made, but this work is not complete.

Progress in reducing the amount of conventional pollutants from point sources has meant that other problems, such as toxic contaminants and nonpoint sources, have taken on greater importance in our efforts to achieve the goals of the law. EPA and the States also are looking more carefully at problems in ground water, oceans, and inland and coastal wetlands.

The following are six of the most significant water quality challenges of the future. The combined attention of EPA, other Federal agencies, the States, local governments and individual citizens will be needed to address these problems and achieve the Nation's clean water goals.

- **Ground-water protection.** Contamination of ground water is potentially the most serious water problem because of the difficulty of detecting and remedying ground-water pollution after it has occurred.
- **Toxics pollution.** Although we have made great strides in controlling conventional pollutants, the problem of toxics contamination from industrial, municipal, and nonpoint sources remains a major challenge.
- **Drinking water.** Public health problems related to drinking water still persist, particularly in small systems. Contamination by man-made organic chemicals may require new techniques to monitor and treat drinking water.
- **Wetlands.** These important local ecosystems have been destroyed, almost as a matter of course, for farming and forestry, disposal of waste, and other land development activities. Although the economic, environmental, and aesthetic value of wetlands is better understood, losses continue today.
- **Pollution from sewage.** Problems remain in assuring continuous adequate treatment at existing treatment plants. Moreover, providing adequate capacity to handle population and economic growth will continue to challenge government at all levels.
- **Nonpoint source pollution.** A combined effort of Federal, State, and local governments is needed to help restore and protect surface and ground waters degraded or threatened by nonpoint source pollution.

WATER

Ground-Water Protection

THE PROBLEM

Ground water is a major source of water for agricultural and industrial purposes. It is also an important source of drinking water. About half of all Americans, and up to 95 percent of those in rural areas, rely on ground water as their principal source of drinking water.

Withdrawal of ground water to meet these needs has been steadily increasing. Between 1950 and 1980, withdrawal of ground water in the United States more than doubled (from 34 to 89 billion gallons per day). Withdrawals are expected to reach 100 billion gallons per day by 1985.

There also is evidence that ground water is becoming increasingly contaminated. The most troublesome contaminants include organic solvents, such as trichloroethylene and benzene; gasoline; pesticides and soil fumigants; disease-causing organisms; and nitrates. A recent study by EPA showed that nearly one-third of large public water systems are detecting the presence of man-made chemicals in their ground-water supplies. In addition, recent Congressional studies have indicated that more than 4,000 private, public, or industry wells have been closed or affected by chemical contamination. Many of these wells served only a few individuals; some were the pri- were the primary water source for entire cities.

The sources of ground-water contamination vary from place to place (Figure W-4). Inappropriate waste disposal may present the greatest nationwide threat of ground-water contamination. We now realize that many types of waste disposal, such as industrial and municipal landfills and storage lagoons, pose risks to ground-water quality. Unfortunately, past decisions on locating hazardous waste disposal facilities gave scant consideration to these consequences.

For example, in the mid-1970's, EPA and the States became aware that waste disposal landfills (not just those receiving hazardous waste) were creating ground-water contamination problems. There are an estimated 93,000 such landfills in the United States. The vast majority of such sites produce liquid leachates, contaminated fluids that drain from these areas. Such facilities can be sources of ground-water pollution. However, we have insufficient knowledge of the specific impacts of these sites on ground water.

Similarly, there are about 181,000 surface impoundments (e.g., pits, ponds, and lagoons). Approximately half are located in areas with thin or permeable soils, over ground water currently or potentially used for drinking water. Only about seven percent of all sites appear to be located where they pose little or no threat to ground water.

Septic systems, used by about 29 percent of American households, also discharge waste to ground water. In areas of the eastern United States, they are among the most frequently reported sources of ground-water contamination. Septic systems have always been a threat to ground water from pathogens and nitrates. Now they appear to be a source of hazardous organic solvents as well, flushed down the drain by consumers to degrease the plumbing.

Other sources may account for up to two-thirds of the incidents of ground-water contamination. Improper use of pesticides and fertilizers, coating of roads with contaminated waste oils, use of highway de-icing compounds, leaking underground storage tanks and pipelines, accidential spills and "midnight dumping," abandoned wells, over-pumpage, and excessive drawdowns have all caused ground-water contamination.

Many of these practices go on with little recognition or concern for their potential impact on ground-water quality. The waste contributed through leakage from underground storage tanks is estimated to be considerable. For example, as many as 25 percent of the underground gasoline storage tanks at the 10,000 or more retail gasoline outlets in the State of Maine may be leaking. The estimated waste which leaks each year from these tanks is 11 million gallons.

EFFORTS TO DATE

Until the mid-1970's, ground water was generally viewed as a self-renewing resource. Since then, however, we have recognized that the rate of renewal is being outstripped by the significant threats to ground water by man-made contaminants. Because of these threats, ground-water protection has emerged as a major concern.

States use a variety of mechanisms to protect ground-water quality. These mechanisms include using water-quality standards for ensuring safe drinking water supplies, requiring a discharge permit for some types of discharges, or imposing land-use controls. To deal with contamination incidents, at least 21 States have established cleanup funds. In addition, nearly 40 States maintain monitoring networks for determining the general quality and quantity of ground water within the State. About the same number of States actively monitor the ground water surrounding land disposal facilities for hazardous waste and known contamination sites.

Local governments also have taken action to prevent and address ground-water contamination. Through local zoning, lot sizes have been regulated in some localities to prevent intensive residential or commercial development over ground-water recharge areas. Some have set restrictions on the density of septic systems as well. Some areas, like Long Island and Cape Cod, have enacted strict local control programs to protect ground water.

In addition, EPA has begun to use its authority under several laws to prevent and control ground-water contamination:

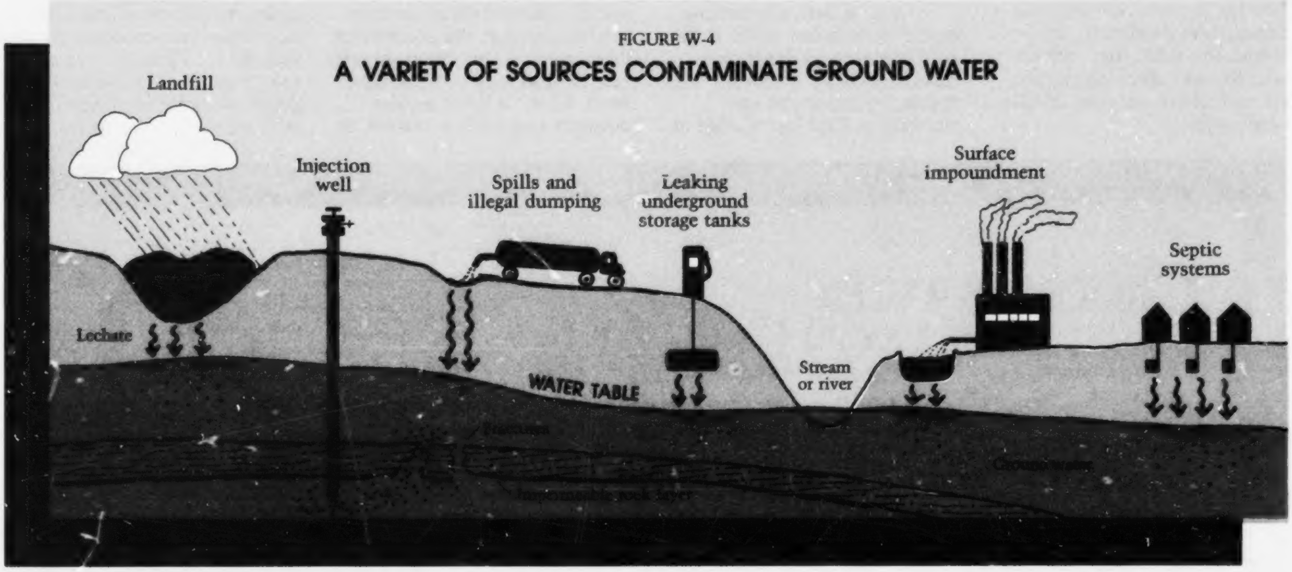


FIGURE W-4

A VARIETY OF SOURCES CONTAMINATE GROUND WATER

- Under the Safe Drinking Water Act, EPA and States protect underground sources of drinking water and regulate the underground injection of fluids. EPA sets "maximum contaminant levels" and publishes health advisories for contaminants in drinking water, including ground water used for drinking. In systems which obtain drinking water from ground water, violations of these standards can indicate contamination. In addition, EPA is progressing with implementation of the Underground Injection Control Program. That program will regulate activity at approximately 160,000 injection wells.

- Under the Resource Conservation and Recovery Act, EPA has implemented regulations to control disposal of solid waste and to provide "cradle to grave" management of hazardous wastes, including control of hazardous waste generators and the transport, storage, and disposal of those wastes. All active hazardous waste landfills now are required to monitor ground water to detect and evaluate contamination. These landfills can be required to correct ground-water contamination.

- The Comprehensive Environmental Response, Compensation, and Liability Act, also called "Superfund," establishes a fund to support Federal and State actions to respond to hazardous waste problems. Of the 546 sites now proposed for priority attention, 410 appear to have caused ground-water problems.

- The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) allows EPA to restrict or prohibit the use of pesticides in places where they most adversely affect ground water. A major effort is under way to review the impacts on ground water from previously registered pesticides.

- Under the Toxic Substances Control Act, if a chemical has the potential to contaminate ground water, EPA has authority to limit certain uses, require warning labels, and take other actions to reduce unreasonable risks from these chemicals. EPA is exploring the problem of leaking underground storage tanks.

- Under the Clean Water Act, funds are being provided to States for water-quality programs, including ground-water management programs. In addition, sewage treatment facilities using land application techniques are required to be designed in a way to protect ground water.

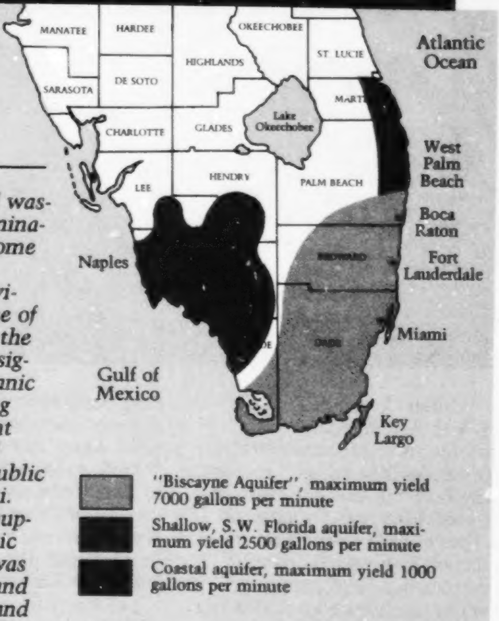
- EPA has a significant research effort devoted to ground-water protection. In addition to research on methods to protect and monitor ground water, EPA is tracking and measuring pollutants at the point of human exposure. Examples include research on where ground water is used as a source of drinking water and determining health effects associated with various pollutant concentrations.

TODAY'S CHALLENGES

Identifying ground-water contamination problems, determining what their effects will be, and cleaning up existing hazards present unique challenges.

Lack of data concerning health effects has made it difficult to set standards or health advisory levels for many ground-water contaminants. Our knowledge of specific ground-water sources is also sketchy. We sometimes do not know the direction and rate of flow in a specific aquifer or where it joins nearby aquifers and surface waters. In addition, data that are available often are not readily accessible. These problems may lead to inaccurate assessments of current or emerging problems and inadequate

GROUND-WATER CONTAMINATION IN FLORIDA


MANATEE
HARDEE
OKEECHOBEE
ST. LUCIE
HIGHLANDS
SARASOTA
DE SOTO
MART
CHARLOTTE
GLADES
Lake Okeechobee
LEE
HENDRY
PALM BEACH
BROWARD
DADE
Atlantic Ocean
West Palm Beach
Boca Raton
Fort Lauderdale
Miami
Key Largo
Naples
Gulf of Mexico
"Biscayne Aquifer", maximum yield 7000 gallons per minute
Shallow, S.W. Florida aquifer, maximum yield 2500 gallons per minute
Coastal aquifer, maximum yield 1000 gallons per minute

The Miami, Fort Lauderdale, and West Palm Beach metropolitan areas are the heart of a major population and economic center that extends for about 100 miles along the Atlantic Coast of Florida. This "Gold Coast" has experienced rapid growth since World World War II, and development continues at a fast pace. In addition to its well-known tourism economy and popularity as a retirement center, the area is also a major light manufacturing center.

Drinking water supplies for about 3.5 million people are obtained from the highly productive Biscayne Aquifer, a sand/limestone aquifer underlying most of the developed area. This highly permeable aquifer has a thickness of about 50 to 200 feet and lies immediately below the ground surface. The aquifer is recharged by rainfall, outflow from the Everglades, infiltration of surface water from numerous drainage canals, and wastewater and surface runoff discharged directly into the ground at numerous locations.

The aquifer is particularly vulnerable to contamination by pollutants introduced in the recharge water. Any release of pollutants into the area environment, such as spills or leaks of chemicals, improper hazardous waste disposal, or discharge of inadequately treated wastewaters, may result in contamination of ground water and, in some cases, of drinking water.

There has been increasing evidence in recent years that some of the drinking water supplies in the region are contaminated with significant levels of synthetic organic chemicals. A national screening survey in 1974 found significant levels of previously undetected organic chemicals in various public water supplies including Miami. Additional sampling of water supplies in Dade County for organic chemicals began in 1977 and was expanded to include Broward and Palm Beach Counties in 1981 and 1982. By 1983, public health officials were concerned about the level of contamination and frequency of occurrence of several volatile organic chemicals. Of about 250 public water supply wells sampled, nearly 20 percent were found to be contaminated with one or more volatile organic chemicals. Most of the wells sampled were in Dade County, but observed levels and frequency of contamination were similar in Broward and Palm Beach Counties.

These 250 wells represented only a small fraction of the area's several thousand public and private wells. The presence of volatile organic chemicals in area water supplies was thus only partially defined. Sources of contamination of some wells had been identified, but in most cases only general conclusions could be drawn. In mid-1983, EPA initiated a more complete study of contamination of these ground-water supplies. We have realized that this aquifer is seriously threatened by man's activities. This problem will require a concerted effort to identify and control the pollution sources and protect drinking water.

efforts to protect ground water.

Three major types of ground-water contamination sources are (1) storage tanks; (2) pits, ponds, and lagoons containing non-hazardous wastes; and (3) municipal landfills. To control leakage from storage tanks, we must learn a great deal more about the problem. A number of States have undertaken an inventory of storage tanks that may be sources of pollution. Some States, like Maryland and California, are establishing design standards and criteria for installing, testing, and maintaining underground storage tanks used for hazardous wastes. In addition, several major oil companies, long aware of their potential liability, have begun an aggressive program to replace old metal tanks and to institute periodic inspection and better inventory controls.

The majority of States have some type of system of issuing permits for pits, ponds, lagoons, and municipal landfills under either State or Federal authority. In implementing these programs, however, they have only recently begun to focus on trying to protect ground water. Some State programs (particularly in New Mexico, New Jersey, Pennsylvania, and California) directly control the discharge of wastes to ground water. However, the level of effort to ensure compliance is quite uneven among the States.

EPA'S AGENDA

The principal challenge to improving ground-water protection is to develop an overall strategy that harmonizes the implementation of many Federal, State, and local programs to protect this critical resource. One of EPA's highest priorities in the next two years is to develop a ground-water protection strategy and provide the necessary leadership and assistance to State and local agencies to implement it.

EPA is considering a strategy with four major elements:

Support State Ground-Water Protection Programs

The States will have the lead role in planning and implementing ground-water protection programs. EPA will encourage the use of existing grant monies for the States to develop ground-water programs. Funds will support efforts to increase the accessibility and quality of ground-water information, develop State action plans, and design permit systems and other regulatory programs to control sources of ground-water contamination.

Control Unaddressed Sources of Contamination

EPA will identify the nature, extent, and severity of ground-water contamination from leaking tanks, and consider developing a national regulatory program based on existing statutes. In the meantime, EPA is issuing a chemical advisory on fuel oil tanks and will work with the States and with trade associations, such as the American Petroleum Institute and the Society of Independent Gasoline Marketers of America, to negotiate voluntary steps to reduce contamination.

EPA also will decide whether more comprehensive Federal control is needed for unregulated pits, ponds, and lagoons and landfills. An ongoing study will identify and classify impoundments, survey State control programs, and recommend any needed Federal or State controls.

Build More Consistency Among EPA Programs

EPA will also issue guidelines under which EPA regulatory and other controls would vary in stringency according to the significance of the ground water to be protected. Several States now classify aquifers to coordinate their own ground-water protection efforts. EPA will work with the States to devise a mechanism to recognize State classification programs, where feasible, in the implementation of EPA programs.

Make Institutional Changes in EPA to Direct Ground-Water Strategy

EPA is establishing a new Office of Ground-Water Protection at Headquarters and a counterpart to the new office in each Region. The Regions' primary responsiblities will be to coordinate ground-water programs carried out under various statutory mandates and to provide guidance, technical assistance, and management support to the States. The Director of the Headquarters Office will work with other EPA programs and Regions to define EPA and State ground-water roles, plan for correction of uncontrolled sources of contamination, identify and resolve inconsistencies among EPA programs, and learn more about the nature and extent of ground-water contamination.

Toxics Pollution

THE PROBLEM

Well closings, restrictions on shellfish beds, fishing bans, and condemnations of homes in Love Canal, New York, and Times Beach, Missouri, are all symptoms of the seemingly pervasive threat of toxic substances. While the most obvious water pollution problems, such as choked, algae-coated lakes and rivers, are due to the "conventional pollutants," toxics present a less visible and ultimately more challenging problem to control.

What is a toxic pollutant? While nearly all of the pollutants we have discussed can be toxic in certain concentrations, we have become concerned about a number of pollutants whose effects appear to be much more insidious, long-term, and effective in extremely low concentrations. These substances are commonly referred to as "toxics." Toxic pollutants may be man-made substances, such as polychlorinated biphenyls (PCBs) and DDT, or naturally occurring substances, such as cadmium, lead, or arsenic. Although the effects of many of these pollutants are not well known, low concentrations of some of these toxic compounds can result in public health problems such as kidney ailments, cancer, birth defects, and damage to aquatic life.

EPA is responsible for defining the levels at which these pollutants may be harmful and developing controls to protect human health and the environment from harmful effects. This is an extremely difficult proposition.

Some pollutants are more toxic than others. For example, the toxicity of copper to aquatic life is 200 times that of chromium. Dioxin's potency as a carcinogen is 1,000 times that of PCBs. Some pollutants, such as certain phenols, are not a major water pollution concern because they readily disappear or volatilize into the atmosphere. Others, like DDT, can remain toxic for long periods of time.

Still others, including PCBs, bind to sediments in the water and may contaminate bottom dwelling organisms such as clams. The bottom sediments of the Hudson River, New York, and the Lake Michigan Basin contain PCBs and metals which in turn have contaminated fish and other aquatic life.

EPA encourages the use of biological methods, such as this test which exposes minnows to pollutants to assess the toxicity of wastewaters.

Toxic pollutants can also affect an ecosystem by eliminating sensitive species. Studies of the Chesapeake Bay have shown that areas with highly toxic sediments support only worms and a few other organisms that can survive in these highly polluted waters. Areas that are not as contaminated have a rich variety of different organisms, including crabs, clams, and oysters.

While the greatest source of toxics is municipal and industrial wastewater, nonpoint sources are also a major contributor. In agricultural areas, runoff may contain pesticides. In urban areas, runoff may be contaminated with heavy metals, gasoline, and asbestos. Hazardous waste disposal sites, landfill sites, and abandoned mines are among other sources. Another source, yet to be fully investigated, is the atmosphere. Attaching themselves to small particles of dust, toxic substances may be transported far from their source. For example, high levels of toxaphene were found in trout taken from Siskiwit Lake, a small lake located on an isolated island in Lake Superior. Since there are no other known sources, the toxaphene must have come from the atmosphere.

TOXIC CONTAMINATION IN PUGET SOUND

The public and the legislature in Washington State recently became alarmed by reports showing high rates of fish abnormalities due to toxic contamination in Puget Sound. There is significant concern about potential human health effects from eating fish caught in the Sound's urban bays and about the long-term effects on marine resources.

A large number and wide range of sources of toxic contaminants in the Sound have been identified, including municipal and industrial discharges, surface runoff, leachate from nonpoint sources, and atmospheric deposition. Some contaminants also reach the Sound indirectly, from rivers and ground water. Ultimately, physical and chemical processes in the Sound redistribute contaminants. Where they come to rest is not certain, but evidence suggests they are not carried to the open sea. In the past marine water quality data collection and pollution control focused primarily on conventional pollutants. We must now adjust existing programs or develop new approaches to gather data and establish effective toxic control programs.

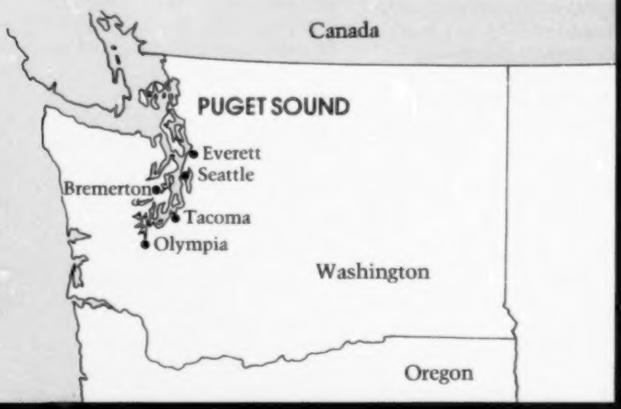
However, because circumstances are forcing immediate actions by regulatory officials, decisions must be made on the basis of incomplete knowledge. Immediate questions include:

- *Should fishing be banned in certain areas?*
- *Should technology-based National Pollutant Discharge Elimination System permits be revised with stricter limits on toxic discharges to meet water quality needs?*
- *What additional contaminants should be limited, and to what levels?*
- *Where should enforcement actions be focused?*
- *What criteria should be used to control disposal of contaminated sludge?*

The State of Washington Department of Ecology and EPA officials have joined in a Puget Sound Water Quality Management Program to manage environmental risks in Puget Sound. The plan has two related parts. One is closely focused on urban industrial bays (e.g., Seattle, Tacoma, and Everett) where high numbers of diseased fish and shellfish have been found and sediments are heavily contaminated. The other part of the program covers Puget Sound as a whole.

Top priority has been assigned to Commencement Bay (Tacoma) and Elliot Bay (Seattle). Work to define problems and identify waste sources already is under way in these bays. Work on the Sound as a whole involves assessing existing contaminant levels and discharges and improving methods to predict effects of future activities.

Restoring the Sound poses extremely complex scientific, economic, and political challenges. Only with the combined efforts of EPA, the State, and the citizens of the Northwest will we save this valuable resource for future generations.



EFFORTS TO DATE

To understand current and future actions by States and EPA to control toxic discharges, a perspective on past efforts is needed. These past efforts were based on the 1972 requirements of the Federal Water Pollution Control Act that all industries meet discharge limits reflecting the use of the best practicable control technology (BPT) by July 1, 1977. BPT is generally defined as the "average performance" that could be achieved by wastewater treatment methods available to the industry. Since the importance of toxic pollutants was not fully realized in 1972, these BPT limitations were primarily aimed at controlling "conventional" pollutants, such as oil and grease.

Compliance with these BPT limitations now nears 90 percent. With full compliance, EPA foresees nationwide reductions from 1972 levels of four key conventional pollutants: biochemical oxygen demand by 69 percent; suspended solids by 80 percent; oil and grease by 71 percent; and dissolved solids by 52 percent.

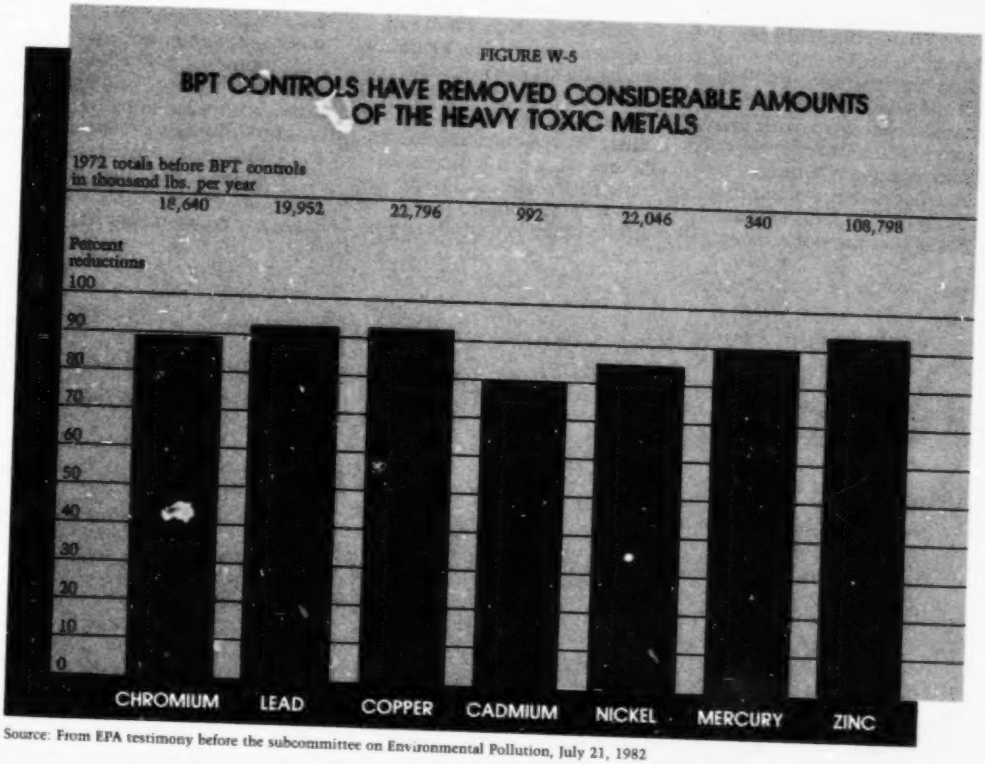


FIGURE W-5

BPT CONTROLS HAVE REMOVED CONSIDERABLE AMOUNTS OF THE HEAVY TOXIC METALS

Source: From EPA testimony before the subcommittee on Environmental Pollution, July 21, 1982

In 1977 the Clean Water Act was amended to control toxics more aggressively. Congress required EPA to adopt more stringent technology-based limitations on certain toxic and nonconventional pollutants. These new requirements were labelled the Best Available Treatment Economically Achievable (BAT). Because of delays, EPA was sued and put under court orders to complete BAT guidelines for 65 classes of pollutants. More than half of the court-ordered BAT rules are now completed, and all will be issued by the end of 1985.

Best available treatment will significantly reduce the discharge of toxics. In determining BAT limits, EPA found that the less stringent, best practicable limits (BPT), though aimed at conventional pollutants, incidentally reduced toxics as well. Figure W-5 shows reductions of certain toxics achieved under BPT treatment requirements.

More progress is in sight as BAT limits are incorporated into individual permits. For example, iron-and-steel industry achievement of BAT will reduce total toxic organics in discharges by 20 percent and total toxic metals by 60 percent. In addition, EPA is developing rules to limit the amounts of toxics an industry may discharge to a publicly owned treatment works. These "pretreatment" regulations will require industries to treat wastes before discharging them to a municipal sewage system.

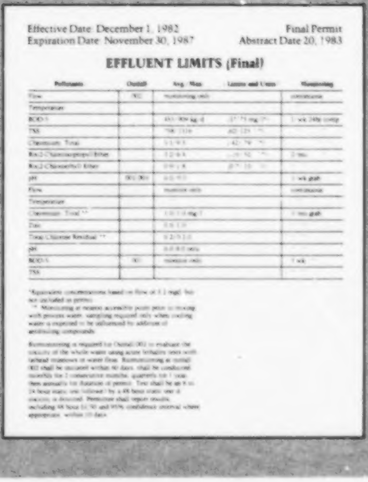
TODAY'S CHALLENGES

In addition to the conventional pollutants, the Agency's water program has focused primarily on the 65 toxics named by Congress in the Clean Water Act. However, there are hundreds of other toxic substances introduced into our waters. Although the Agency has developed controls for some of them, far less information is available on the toxicity of most of these pollutants.

We have a limited scientific basis for developing criteria documents that set forth the effects of many of these pollutants on human health and aquatic life. In addition, innovations in the pesticides, pharmaceutical, and "high tech" industries often involve new production processes and raw materials, and consequently new wastewaters. We must make sure that existing wastewater treatment methods effectively remove these new pollutants.

HOW DO PERMITS CONTROL TOXICS?

Every facility which discharges waste in U.S. waters requires a permit. The permits set the requirements for the average and maximum limits of specific pollutants in the discharge. The permit also sets the frequency that the facility operator must monitor to assure compliance with their permit. Because many discharges are very complex mixtures and limits can not be set for all the pollutants, some permits also require periodic biological monitoring to evaluate the toxicity of the whole waste. A finding of toxicity or bioaccumulation can result in the imposition of a toxicity reduction plan or modification of the permit. This is an example of a permit requirements from an organic chemicals plant in Ohio.



Effective Date: December 1, 1982
Expiration Date: November 30, 1987

Final Permit
Abstract Date 20, 1983

EFFLUENT LIMITS (Final)

EPA'S AGENDA

Implementing monitoring and control strategies for toxics in surface waters is one of EPA's highest priorities for the remainder of this decade. It is EPA's job to work with the States and reissue industrial and municipal discharge permits to incorporate the best available treatment (BAT) standards required by the Clean Water Act. The process of developing national limits for industrial categories has taken several years of difficult technical and policy analysis. It required that EPA look at each industrial category and choose limits reflecting the use of best available treatment to remove toxic contaminants. EPA will complete the development of national limits for the court-ordered industrial categories in 1985.

In a related effort, the Agency will assess the need for additional guidelines to meet water quality standards. This may be a special concern for areas with the "high tech" industries. Knowing what new raw materials and products are involved in these new industries, EPA will determine what treatment methods will be effective.

EPA recently reiterated to the States that they must ensure that all streams meet water quality standards for fishing and swimming with few exceptions. The Agency and States anticipate the permits incorporating BAT requirements may not always, however, protect aquatic life from toxics. Where this is the case, EPA will help States decide how to set more stringent pollution controls. EPA also has issued a new policy which encourages the use of biological methods to assess the acute and chronic effects of toxic discharges. In some cases, this policy will require dischargers to regularly report on the effects of their effluent on aquatic organisms as part of their permit conditions.

Other toxic chemical control activities being pursued include the dioxin strategy. (See section on Dioxin). In addition to cleaning up sites known to be contaminated with dioxin, EPA and States are monitoring other areas to determine the extent of dioxin contamination. Fish tissues will be examined in this study to determine whether other pollutants should be further studied and controlled.

Drinking Water

THE PROBLEM

Along with controlling ground-water contamination, the most significant challenges facing EPA and States to protect drinking water supplies are to (1) eliminate disease-bearing organisms, primarily in small water supply systems; (2) develop standards for toxic contaminants; and (3) control contamination from distribution systems.

Bacteriological Violations in Small Systems

All naturally occurring water contains microbes — bacteria, viruses, and protozoa. While most such organisms are harmless, some are pathogenic. They can cause diseases such as cholera, dysentery, and giardiasis. Although most drinking water now meets national standards for bacteria, a few systems persistently fail to meet the standards. Thousands of cases of disease from contaminated drinking water still occur each year. Such contamination occurs mostly in small public water supply systems which typically rely on untreated ground water, unfiltered surface water, or poorly protected springs (see Figure W-6). Microbial contamination continues to be a concern because contaminated drinking water systems can rapidly spread disease.

Drinking water: a precious resource

Lack of Standards for Toxics

When the Safe Drinking Water Act was passed in 1974, little information was available on contamination of drinking water by toxic chemicals. Analytic methods, descriptions of drinking water supplies, treatment techniques, and costs all had to be developed before standards could be set.

In the late 1970's, a group of organic chemicals called trihalomethanes (THMs) were the focus of regulatory attention. These chemicals, including some known carcinogens, occur as a by-product of disinfection to kill organisms that may cause disease. In 1979, shortly after national standards were developed for trihalomethanes, attention shifted to volatile organic compounds (VOCs). These chemicals are manufactured in billions of pounds annually. A recent EPA survey found VOCs in ground-water sources of drinking water more frequently than had been expected.

Another concern is contamination of drinking water supply systems across the country with pesticides. Although most heavily used in agriculture and forestry, these chemicals are commonly used in homes and on construction sites. Recent discoveries of pesticides in drinking water have made their detection and control a high priority.

Contamination in Distribution Systems

Poorly maintained drinking water delivery systems — including reservoirs, pumping stations, and distribution lines — can contaminate clean drinking water before it comes out of the tap. Twenty percent of waterborne disease in the United States is caused by pathogens entering water by way of the distribution systems. For example, *Legionella*, the cause of Legionnaire's Disease, can breed in water distribution systems although we do not know if infection can occur from drinking water. Excessive levels of lead from pipes have been found in some tap water samples.

Persistence and regrowth of organisms in distribution systems depend on the physical and chemical characteristics of the water, the age of the system, the variety of pipe materials in use, the availability of sites suitable for colonization, and other factors. Delivery systems account for 80 percent of the cost of water supply and problems are expensive to correct. However, correction of contamination due to faulty distribution systems is a major consideration in drinking water improvement programs.

EFFORTS TO DATE

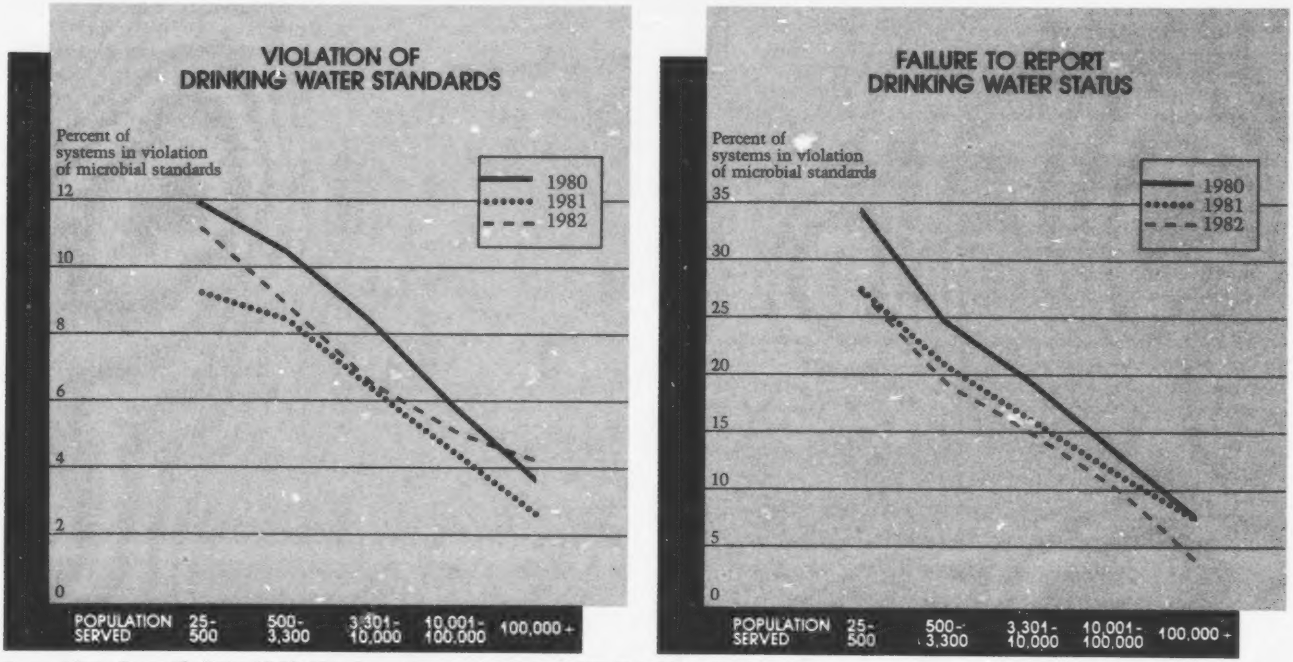
Federal legislation to protect drinking water dates from the turn of the century when the Nation had a larger death rate from waterborne disease than it currently has from auto accidents. In 1974 Congress passed the Safe Drinking Water Act because of concern about contaminants in drinking water and uneven State supervision of public drinking water supplies.

Regulations under the law set maximum contaminant levels (called MCLs) for coliform bacteria, turbidity, and a number of inorganic, organic, and radioactive chemicals. These regulations also call for periodic monitoring of public water supplies for the specified contaminants and notification of water users when any of the standards are exceeded. Violations of drinking water criteria — as well as of monitoring and reporting requirements — are analyzed periodically by State agencies and EPA.

EPA also publishes health advisories to help local and State officials determine the health hazard of unregulated contaminants in drinking water. This guidance includes available scientific data and information on analytical methods and treatment techniques. State and local officials use these health advisories to select measures to protect public health where contaminants for which no MCL has been established are found in drinking water supplies.

FIGURE W-6

SMALL SYSTEMS ARE THE MOST FREQUENT VIOLATORS OF DRINKING WATER STANDARDS



Source: *A Status Report: The National Public Water System Program (May 1982 and 1983)*, EPA's Office of Drinking Water

TODAY'S CHALLENGES

More than 50,000 small drinking water systems serve 11.4 percent of the U.S. population relying on community water supply systems. These systems typically have the greatest problems with microbial contamination. Similiar problems can often occur at the over 160,000 private wells and systems that serve seasonal facilities and the travelling public. Supervising and monitoring such small systems is expensive, time-consuming work, and States commonly assign higher priority to systems serving larger numbers of people. Thus, communities with small drinking water systems traditionally receive low priority, and violations, when they do occur, may go uncorrected.

The need to monitor water for toxic organic compounds at extremely low concentrations is emerging as an economic and health issue of enormous importance. Cost-effective analytical methods that are comparatively easy to use are needed.

Little information is available on deterioration of delivery systems. Preliminary studies indicate significant drinking water quality problems are caused by antiquated systems that need repairs or replacement of pipe networks. For example, tuberculation, the build-up of rust and other by-products of corrosion, is a serious problem in older systems with metal pipes. These build-ups not only reduce drinking water quality but also restrict capacity, increasing operating costs and interfering with service.

Protecting drinking water reservoirs from contamination is essential for ensuring public health.

Rapid population growth is generating more and more wastes. If not disposed of or treated properly, these wastes will increase the potential for microbial and chemical contamination of surface and underground supplies of drinking water. Growth in rural areas is likely to further strain small supply systems that already have difficulty complying with the law.

Safe drinking water depends on adequate well-run drinking water supply and delivery systems. Equally important is preventing pollutants from reaching drinking water sources in the first place. Our efforts to protect the quality of surface and ground waters are instrumental to ensuring continued supplies of safe drinking water.

EPA'S AGENDA

The centerpiece to the national safe drinking water program is the national primary drinking water regulations. These regulations set the "Maximum Contaminant Levels" for different pollutants that drinking water systems must meet.

EPA is currently revising these regulations in phases. In order, EPA will revise the regulations for (1) volatile organic chemicals (VOCs); (2) other organic chemicals (including several pesticides), inorganic chemicals, and microbiological contaminants; (3) radionuclides; and (4) disinfection practices and by-products. In the last phase EPA will review the recent trihalomethanes regulations.

The main objective of EPA and State drinking water programs is to eliminate persistent violations of microbiological standards. EPA will promote improved treatment facilities at small water systems and stress good operation and maintenance. The Agency will continue to develop less expensive techniques that small systems can use to control biological contaminants.

Where necessary, EPA and the States will take enforcement actions against violators of drinking water standards. First priority will be given to public health threats and recalcitrant and persistent violators.

One major effort will be to improve compliance by very small systems serving transient or intermittent populations. As a first step, EPA will identify the most critical systems serving the most people or people most susceptible to disease, such as the systems at summer youth camps, hospitals, and restaurants.

A GIARDIASIS OUTBREAK RENO, NEVADA - 1982

Giardiasis is a significant public health hazard which can be transmitted through drinking water supplies. The disease, caused by the parasite Giardia lamblia *is characterized by weight loss, weakness, diarrhea, nausea, and abdominal cramps. This intestinal disorder was originally thought to affect primarily backpackers and other outdoor enthusiasts who drank from mountain streams contaminated by infected animals. In recent years, however, the incidence of giardiasis in more urban areas has sharply increased. There have been numerous epidemics attributable to contaminated community water supplies.*

One such outbreak of giardiasis occurred in Reno, Nevada (population 140,000), located just east of the Sierra Nevada Mountain Range, near Lake Tahoe. Reno obtains most of its water from the Truckee River which originates in the Sierra Nevada Mountains and is generally of very good quality. However, there are several communities upstream, and the watershed receives intense recreational use, creating a high potential for contamination.

In November 1982 the Washoe County District Health Department detected an increase in the incidence of giardiasis in the area. By December there were 340 cases of giardiasis reported in the area. Suspecting a possible waterborne disease, the County immediately recommended increased chlorination and additional sampling of the water system. The County requested assistance from the Center for Disease Control (CDC) in Atlanta, Georgia and the Environmental Protection Agency (EPA).

The CDC conducted a detailed epidemiological investigation and concluded that the outbreak was waterborne. Based upon previous investigations of similar outbreaks in other parts of the country, EPA recommended ways to modify the water treatment. The number of cases of giardiasis dropped significantly. For the long term, a new filtration system will virtually eliminate the risk of future waterborne giardiasis outbreaks.

The Reno, Nevada giardiasis outbreak was an excellent example of how local, State, and Federal public health agencies worked together to respond to a public health emergency.

Wetlands

THE PROBLEM

Once regarded as wasted land, wetlands now are understood to provide irreplacable benefits to people and the environment (Figure W-7). Wetlands provide natural flood-prevention and pollutant-filtering systems and contribute significantly to groundwater recharge. Wetlands in the Charles River Basin of eastern Massachusetts, for example, absorb floods that otherwise would cause millions of dollars in annual damage. These wetlands also are valued at $17,000 per acre each year for their equivalent waste-treatment capacity.

Destruction of wetlands also reduces wildlife populations. Many sport fish, migratory waterfowl, furbearers, and other valuable wildlife live and breed in wetlands. A third of all endangered species depend on wetlands for some part of their life cycle.

Piecemeal destruction of U.S. wetlands has destroyed slightly more than half of the Nation's original resource. Between the 1950's and the 1970's alone, over 7.6 million acres were drained or filled (Figure W-8). Over 95 percent of this acreage was inland fresh-water wetland; the rest was coastal or salt-water wetland. Thousands of acres are still being filled or drained each year.

EFFORTS TO DATE

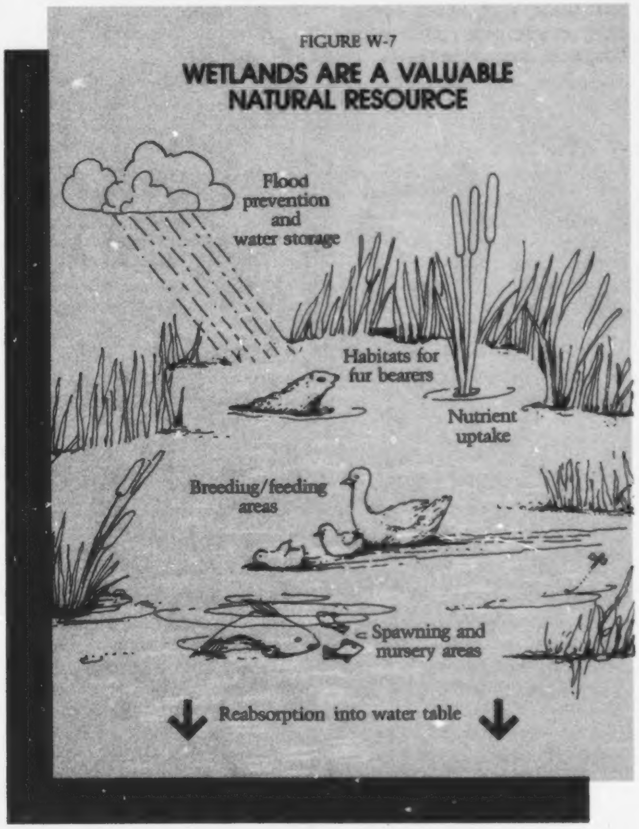
By law, wetlands are considered "U.S. Waters" and are protected like streams, lakes, and rivers. Under Section 404 of the Clean Water Act, EPA and the U.S. Army Corps of Engineers work together to protect valuable wetlands. Dumping dredged or fill material into U.S. waters is prohibited unless authorized by a "404 permit" issued by the Corps. EPA and other Federal or State agencies review permit applications and advise the Corps as to the environmental effects of proposed activities.

Where wetlands development must be permitted, environmental losses may be at least partly offset. For example, in Puerto Rico, when no practical alternatives to dredging and filling wetlands can be found, developers must plant mangroves in new areas of equal or greater size. In Green Bay, Wisconsin, builders of an interstate highway created a wetland for migratory waterfowl to compensate for one destroyed in the highway construction.

The Fish and Wildlife Service is creating an inventory that will classify and map the Nation's wetland resources. These maps will identify wetlands and help reduce further losses.

FIGURE W-7

WETLANDS ARE A VALUABLE NATURAL RESOURCE

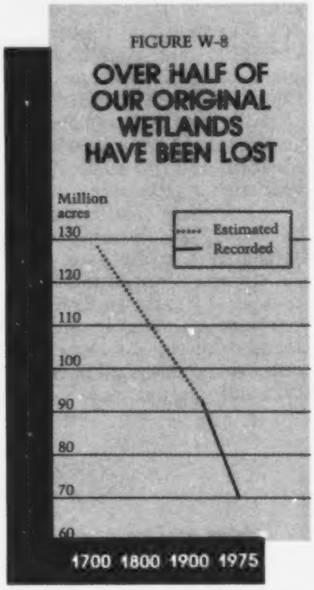

Flood prevention and water storage
Habitats for fur bearers
Nutrient uptake
Breeding/feeding areas
Spawning and nursery areas
Reabsorption into water table

TODAY'S CHALLENGES

Growth is the greatest threat to wetlands. Population migration and urban sprawl are rapidly encroaching on wetlands. Recreational and residential developers seek to develop attractive coastal islands and other wetlands. In the Midwest, farmers want to drain prairie potholes for agriculture. Southern farmers seek to expand into bottomland hardwoods, particularly along

FIGURE W-8

OVER HALF OF OUR ORIGINAL WETLANDS HAVE BEEN LOST



Source: *Environmental Trends*, Council on Environmental Quality, 1981 the alluvial plain of the Mississippi River. (See highlight on Bottomland Hardwoods.) There is a steady and potentially increasing demand for Federally sponsored dredging to maintain and deepen navigational channels.

Industrial development also puts pressures on wetlands. Intensive peat mining in eastern North Carolina is threatening thousands of acres of wetlands. The development of freshwater canal systems in Alabama and Mississippi is changing water movement in the area upsetting the ecological balance of wetland areas. These and other developments may be economically valuable, but we pay with the loss of wetlands.

The cumulative impacts of numerous small undertakings that fill or drain wetlands also are of concern. Each action by an individual landowner may not cause great harm, but cumulatively they add up to sizable net losses of wetlands.

The value of wetlands as a unique natural resource is not yet widely appreciated. This may be the greatest barrier to preservation of the remaining wetlands. Many government policies and regulations still endorse the conversion of wetlands. For example, agricultural price supports, flood insurance programs, and relatively high rates of taxation of wetlands all encourage alternative uses of wetlands.

EPA'S AGENDA

Protecting the wetlands through vigorous attention to review of Section 404 permits is at the top of EPA's priority list for the next two years. EPA will work closely with the Corps to improve the effectiveness of the Section 404 program in protecting the Nation's aquatic resources. EPA is currently developing guidance to clarify the jurisdiction of the program and to identify which wetlands are most ecologically important where developmental pressures are greatest. For example, EPA has initiated a study of bottomland hardwood wetlands to evaluate the effects of conversion of this valuable resource to agricultural uses. Similar studies are being planned to assess the impact of development on tundra wetlands in Alaska, prairie potholes in the Northern Plains States, and pocosine (freshwater) swamps along the Atlantic coast. EPA is also assessing techniques to minimize the effects of wetland losses and the individual and cumulative impact of placing dredged and fill material on wetlands.

Another priority is to transfer permitting authority to the States. EPA will encourage more States to develop their own capability to review proposed 404 permits for wetlands conversion. In cooperation with the States, EPA also will investigate more effective means to protect small inland wetlands, typically small bogs, marshes, and swamps that have been casually filled in the past.

A Great Blue Heron

BOTTOMLAND HARDWOODS

Bottomland hardwoods are forested freshwater wetlands adjacent to rivers in the southeastern United States, primarily in the lower Mississippi River Valley area. They are valuable for wildlife breeding as nesting and habitat areas; protecting water quality by acting as natural filters to capture water pollutants; and, especially, as natural basins to contain flood waters and reduce downstream damage. Levee construction, combined with clearing and development of wetlands on the floodplains of major waterways and their tributaries, has destroyed breeding areas, greatly exacerbated flooding, and increased total pollutant loadings. This is especially true in the Mississippi Valley where many thousands of acres have been cleared and converted to row crops and pine plantations.

The intense pressure to clear these areas has not diminished. Like many other types of wetlands, conversion of bottomland hardwoods to other uses raises difficult questions of land use, the cost of man-made controls, and the broader implications of environmental protection versus individual rights of ownership.

WATER

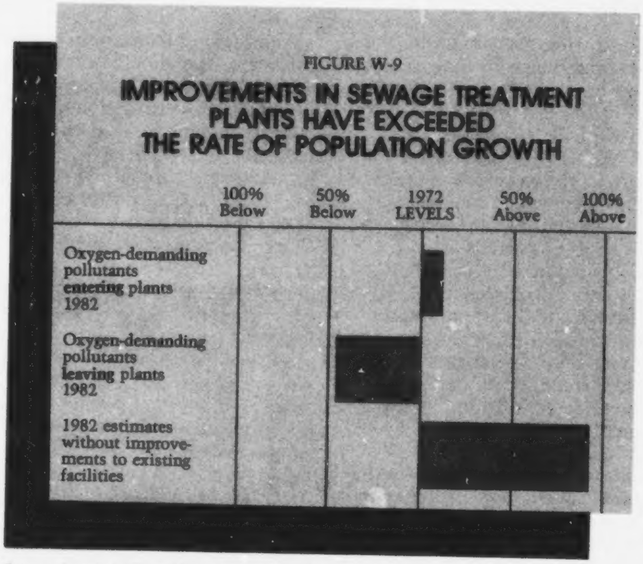
Pollution from Sewage

THE PROBLEM

Raw or insufficently treated sewage from municipal and other wastewater treatment plants still threatens fish, shellfish, and recreational resources in many parts of the country. Organic matter and plant nutrients in sewage foster excessive growth of algae and other aquatic plants. These plants then die and decay, depleting the dissolved oxygen needed by fish. Moreover, poorly treated wastewater may contain bacteria and chemicals toxic to both human and aquatic life.

FIGURE W-9

IMPROVEMENTS IN SEWAGE TREATMENT PLANTS HAVE EXCEEDED THE RATE OF POPULATION GROWTH



Source: *America's Clean Water*, Association of State and Interstate Water Pollution Control Administrators, 1984

EFFORTS TO DATE

The Congress saw in the late 1960's that local and State governments needed Federal help to build sewage treatment plants. Since the 1970's, more than $40 billion has been appropriated by Congress. EPA has awarded $37 billion in grants, and State and local governments have spent more than $13 billion to build thousands of treatment plants and other sewage facilities.

In 1982, the great majority of the Nation's 224 million people were served by adequate sewage treatment.

- Eighty-three percent, or 186 million people, were served by sewer plants or on-site systems providing treatment equal to or better than levels required by the Clean Water Act. Of that total, 142 million were served by plants providing the secondary levels of treatment required by the Clean Water Act, or better. This was an increase of 57 million people since 1972. The remaining 44 million people were served by adequate on-site septic systems.
- Ten percent, or 23 million people, still were served by plants or on-site septic systems providing less than adequate treatment. The number

of people in areas where public sewage treatment systems are needed, but who were not served by such facilities, dropped 33 percent from 21 to 14 million people.

- The number of people using sewer lines that merely dump raw wastes into streams dropped 60 percent from 5 million to 2 million in the decade.

While not yet an unqualified success, the program to build sewage treatment plants, set discharge limits for these plants, and enforce these limits has reversed water quality deterioration in thousands of miles of waterways around the country. The reopening of beaches and shellfish beds and the return of desirable fish to many rivers and harbors is largely due to gains from these programs. Especially in areas where population and industry have grown rapidly, the construction of sewage treatment plants has been essential to reduce the amount of pollution and prevent further loss of water quality (Figure W-9).

TODAY'S CHALLENGES

Some large cities and rural communities still discharge raw sewage. Most remaining sewage pollution problems, however, are a result of sewage that gets inadequate treatment at existing treatment plants. Among the leading causes for failures at existing systems are overloading and poor operation and maintenance. Toxic substances in the wastewater entering the plants also remain a source of problems.

Overloading

Overloading is often a result of failure to anticipate the needs of growing communities. The time required to adequately plan and construct additional treatment plants may be ten years or more. Planning for new treatment plants must begin long before the problems of overloading become obvious. The purpose of the Federal grant program was to construct treatment plants to meet existing needs. State and local governments must shoulder the costs to construct additional treatment plants to support growing populations.

Overloading is also a problem where storm and sanitary sewers are connected in one "combined sewer system." During a heavy rainstorm, rainwater runs off city streets into sewers and overwhelms plant capacity, resulting in the discharge of untreated sewage.

Poor Operation and Maintenance

Poor operation and maintenance leads to breakdowns, disruptions of treatment, and untreated or only partially treated discharges. Although it was clear from the outset that

THE POLLUTION SOLUTION FOR SMALL COMMUNITIES

Pollution control in small communities can be effective without being complex or costly. The following case study illustrates how a little ingenuity and analysis of the sources of a problem produced results for one area in the Midwest.

In the late 1970's, several communities on rural lakes in Minnesota were about to initiate sewage treatment projects that would have cost $4,000 or more per home, even after the 75 percent Federal contribution. This is twice the average cost. One plan to serve 10,000 people called for 85 miles of sewer mains, an extraordinary amount for that number of people. Another would have cost local residents one-and-a-half to two-and-a-half times the value of their homes.

EPA's regional staff in Chicago found ways to cut Federal and local costs and solve the real pollution problems at the same time. The first step was to see what was needed. Aerial infrared surveys pinpointed septic tank pollution. At one lake only 90 of 1,500 nearby septic tanks discharged into the lake, and only 2 of those were causing pollution. The obvious conclusion in that situation: solve the problem of the 2 tanks instead of replacing all 1,500 with a costly, new centralized sewage treatment plant.

In examining the communities' proposed plans, EPA weighed the costs of rehabilitating existing systems rather than installing new ones. EPA considered simple collection and treatment systems and explored every available technology for reducing the problem, even the use of water-saving shower heads.

The result: the real pollution problems were solved at a fraction of the original cost. Total project costs were reduced 30 to 70 percent. Local costs were cut by 60 to 80 percent, and long-term maintenance is expected to be reasonable.

plants built under the grant program would be operated and maintained by local authorities, some cities have been unable or unwilling to operate or maintain their sewage treatment plants.

The number of systems failing to meet the discharge limits in their operating permits is considerable. Of the approximately 3,600 major treatment plants designed to handle more than 1 million gallons per day, over 600 are not in compliance with their permit limits.

Some problems occur because municipal systems are too costly or sophisticated for small communities to operate. Some local agencies, lacking knowledge of operations, costs, and management, overlooked simpler, more appropriate technologies. Elaborate systems often proved too large and sophisticated for small communities.

Toxic Substances

Toxic substances passing through municipal sewage treatment plants are another major cause of breakdowns or poor operation. In many communities, plants without in-house treatment facilities put industrial wastes directly into the municipal system. Some industrial wastes include heavy metals and toxic organic chemicals. Most municipal sewage treatment plants can remove 75 to 80% of these toxics. In some cases, however, such substances can kill the microorganisms essential for the plant's filtering systems and otherwise disrupt the plant's operations. This results in the untreated sewage and toxics passing through into a waterway. The toxics can also be retained by the plant's treatment process and contaminate the sludge, exacerbating the problems of safe disposal of this material. (See the section on Municipal Sludge.)

EPA'S AGENDA

EPA's sewage treatment program has initiated many diverse approaches to solve the problems described above. The following are some of the major actions EPA and the States will pursue in the coming decade to meet these and other objectives.

Evaluate the Need for a Continuous Federal Role

EPA is undertaking a study to be completed in November 1984 of Federal, State, and local roles to achieve expeditious construction of sewage treatment facilities needed to meet the Clean Water Act. Congress originally envisioned the Federal grants program as a short-term effort to meet the Nation's need for sewage treatment plants. It was not intended to be a permanent Federal program. Consistent with this goal, Congress has reduced the funding level for construction grants to $2.4 billion annually and made other changes to reduce the Federal role. In 1984 EPA will evaluate alternative financing for municipal sewage treatment and explore alternative types of assistance to local communities to meet their water pollution needs.

Direct Federal Grants to Significant Water Quality Problems

While the need for a continued Federal program is being evaluated, EPA will work with States to ensure that they direct the remaining Federal grants to projects that will contribute to meeting the environmental goals of restoring and protecting water uses and protecting public health.

Enforce Against Municipal Facilities

Enforcement is the keystone of EPA's strategy to improve sewage treatment nationwide. In January 1984, EPA issued a "National Municipal Policy." According to this policy, Regional EPA Offices will work with State agencies to identify facilities not meeting prescribed effluent limits and develop plans to achieve compliance as quickly as possible. The annual State grant negotiation process will be used to reach agreement on specific activities to achieve compliance.

Carry Out the Industrial Pretreatment Program

EPA, States, and local authorities will require industries to provide better "pretreatment" of wastes before they are sent through public sewage treatment plants. Pretreatment would remove toxic contaminants that disrupt sewage plants and are harmful to people or the environment. EPA will help States expand their water quality analytical capabilities to evaluate pretreatment systems in light of water quality and public health goals.

Improve Sewage Treatment Plant Operations and Maintenance

States are to use Federal grants to continue training for sewage treatment plant operators. EPA will develop guidelines for improving operations and maintenance programs and help communities develop and ensure the financial capability to build and operate municipal sewage treatment works. Training and assistance will be provided to States to enable them to evaluate community capability to support wastewater treatment facilities and to identify high-cost, problem projects before they are constructed.

Provide Incentives for Construction of Small-Scale Technologies

For several years, EPA has provided grant incentives to encourage construction of small-scale wastewater treatment projects that involve simple, less costly technology. These systems often do a better job and are more reliable than conventional or advanced systems. Some systems, for example, recycle and reuse wastewater and its nutrients. Such systems may be suitable for small communities facing very stringent limits on pollution. EPA wants to ensure that communities have systems they can afford to operate and maintain.

Through States and the EPA Regional Offices, EPA is providing information to grant recipients on what works and what does not in sewage treatment technology. EPA encourages innovation in sewage treatment and supports field testing of promising but unproven technologies.

WATER

Nonpoint Source Pollution

THE PROBLEM

In 1982, virtually every State reported having some water pollution problems caused by nonpoint sources, such as agricultural, urban, or construction runoff. Approximately half indicated that nonpoint sources were major contributors to their water quality problems. About one-fifth of the States identified nonpoint sources as their primary cause of surface or ground water pollution.

Sediment and nutrients including animal wastes, fertilizers, herbicides, and pesticides transported from farmlands by rain and irrigation water are the most pervasive nonpoint pollution problems. Sediment, that is, sand, silt, clay, and organic materials, is the largest contributor by volume to nonpoint source pollution. It adversely affects portions of more than two-thirds of all U.S. river basins. Excessive sediment clouds the water and reduces the amount of light which reaches deeper water. This reduces oxygen levels and limits the number of species of aquatic life which can survive. Chemicals such as pesticides and nutrients often bind to sediment particles. Nutrients are also major pollutants from nonpoint sources. While essential to agriculture, nutrients stimulate excessive growth of algae and can seriously deplete oxygen levels in water.

Runoff from urban lands and mines are the next most commonly reported nonpoint source problems. Urban runoff, generally a localized water quality problem, frequently contains heavy metals and other toxic substances. Abandoned mines can cause particularly severe impacts, in some cases resulting in the devastation of stream life. Additional nonpoint sources of localized concern include forestry and construction.

Some effects of nonpoint source pollution are more noticeable to the general public. For example, drinking water costs often rise because additional treatment systems must be installed to remove sediments and other contaminants. In many parts of the country, dams, lakes, reservoirs, and wetlands are slowly being filled with sediment. Fishermen notice shrinking catches, the storage capacity of these waters is reduced, and waters become undesirable or unsafe for swimming and boating.

CONTROLLING AGRICULTURAL POLLUTION IN IOWA

The Problem: Nutrients

Iowa has some significant erosion problems, particularly on agricultural lands. In Shelby County, Prairie Rose Lake is an example of how serious erosion and runoff can be effectively checked. Prairie Rose Lake is man-made and an important recreational resource for west central Iowa. Since 1971, sediment had claimed 10 percent of the lake's boating and fishing areas, and the volume of the lake had been reduced by 19 percent. Nutrients in the runoff entering the lake were stimulating the growth of algae and accelerating the destruction of the lake.

The Prairie Rose watershed has one of the highest erosion rates in Iowa, with an annual average soil loss of approximately 20 tons per acre (the national average is 5 tons or less per year). About 62 percent of the nearby cropland annually loses 30 tons of soil per acre. The first step toward restoring the water quality of the lake was reducing the erosion rates.

The Approach: A Rural Clean Water Project

EPA and the U.S. Department of Agriculture initiated a Rural Clean Water Project (RCWP) on the watershed in 1980. The goals were to control soil erosion on 80 percent of the cropland, with 75 percent of the landowners participating. Cost-share funds amounting to $700,000 were made available through the RCWP in 1980 to implement the project. The Soil Conservation Service is developing contracts with landowners that call for erosion and pollution control. By October 1983, landowners had signed contracts covering 75 percent of the cropland in the area.

The Results: Dramatic Water Quality Improvements

Various best management practices are being implemented under the Prairie Rose Lake RCWP for soil erosion control, pesticide management, and nutrient management. As of November 1982, conservation tillage was being used on 560 acres, permanent vegetation was planted on 48 acres, 50 miles of terraces had been built, and 8 sediment retention basins had been constructed. In addition, 23 farms were employing both nutrient management and integrated pest management systems.

After two years of use, these pollution control measures have led to dramatic improvements in the water quality of Prairie Rose Lake. Between 1981 and 1982 the amount of sediment flowing into the lake dropped by almost 50 percent. Pesticides and nutrients that were entering the lake attached to the sediment were also reduced proportionately. Water near the surface became 33 percent clearer and bottom water became twice as clear as it had been. Levels of phosphorus and the algae were also significantly reduced. Through a concerted effort, landowners checked the erosion and runoff into Prairie Rose Lake and saved it from destruction.

Reproduced from best available copy.

EFFORTS TO DATE

Experts believe that a significant portion of nonpoint pollution problems can be solved through better management of activities such as farming, forestry, construction, and mining. The Federal Government, through a number of agencies, provides technical and financial help to State and local agencies to compile nonpoint source information and develop control programs. The U.S. Department of Agriculture, for example, has several programs to control soil erosion and chemical runoff from farmlands. The Office of Surface Mining at the Department of Interior is generally responsible for reducing drainage from mines.

The Clean Water Act recognizes that nonpoint source pollution is best managed at the State and local level. EPA provides grants to assist State agencies to revise and update their water-quality management (WQM) plans. These plans identify water-quality problems and necessary control action. Most often the plans rely on "best management practices" or cost-effective and practical methods to prevent or reduce nonpoint source pollution. The most common best management practices are voluntary and apply to runoff from agriculture sources. For example, conservation tillage reduces erosion by leaving crop residues on the soil, streambank protection practices reduce sediment runoff into streams, and contour plowing reduces runoff from sloping lands. Although most best management practices are voluntary, there are a number of enforceable State laws or local ordinances. For example, 16 States have enacted laws to control runoff from construction sites.

TODAY'S CHALLENGES

Nonpoint sources present continuing problems for achieving national water-quality goals in many parts of the country. They are estimated to have a major impact in as many as 60 percent of our streams and 75 percent of our lakes. The manner and extent to which specific nonpoint source problems are addressed, however, varies widely.

For example, although agricultural nonpoint sources are a pervasive problem, only 19 States have assistance programs for best management practices in agriculture. Additionally, most of these programs were originally established to control soil erosion, not to improve water quality and therefore focus primarily on where soil erosion is most severe, not where sediment will have the greatest impact on stream quality or use. In addition, few States have nutrient management programs for agriculture. Recently, some States have modified their programs to include water-quality objectives.

Most solutions to nonpoint pollution lie with individual actions. Because benefits, such as improved recreational opportunities, seem to accrue more to society as a whole than to an individual landowner, control measures may appear unduly burdensome to individual landowners. These benefits, along with the benefits to farmers of reducing soil erosion or chemical runoff through better tillage practices, have to be balanced with the additional cost or inconvenience of implementing best management practices.

Uncontrolled storm-water runoff from a cornfield

EPA'S AGENDA

In a number of areas, the control of nonpoint sources of pollution will be necessary to maintain water quality and meet the goals of the Clean Water Act. The sensitive local land use decisions needed to implement nonpoint source controls are best made at the State and local level. As stated in the "Report to Congress: Nonpoint Source Pollution in the U.S." issued by EPA in January 1984, Federal programs should provide advice on controlling nonpoint source pollution as part of technical assistance on soil conservation, agriculture and forestry. Federal agencies will also need to continue to support research on needed control methods and disseminate information on innovative management approaches.

LAND

Preceding page blank

LAND

Environmental protection has historically focused on air and water pollution. While the Federal Government has been involved in protecting wildlife and other natural resources since the turn of the century, it was not until the 1970's that there was much public concern about pollution of the land. Now contamination of the land not only threatens future uses of the land itself but also affects the quality of the surrounding air, surface water, and ground water. Love Canal in New York State, the Valley of the Drums in Kentucky, and Times Beach in Missouri are notorious examples of this. All have been severely damaged by careless disposal of hazardous waste.

While these sites are among the worst, similar situations across the country have raised public awareness of the environmental and health threats posed by hazardous wastes. Without question, the public's top environmental priorities are to clean up these problems and to regulate current hazardous waste handling to prevent similar problems in the future.

EPA is working with State and local governments to determine which sites present the greatest dangers and to take appropriate action as expeditiously as possible. To prevent a proliferation of problem sites, governments at all levels now require newly generated hazardous wastes to be treated or disposed of in an environmentally sound manner.

This chapter begins with an overview of problems in the generation and disposal of waste, EPA's approach to waste management, and progress achieved so far. The rest of the chapter describes four key land disposal problems facing the Nation and EPA's plans to address those problems.

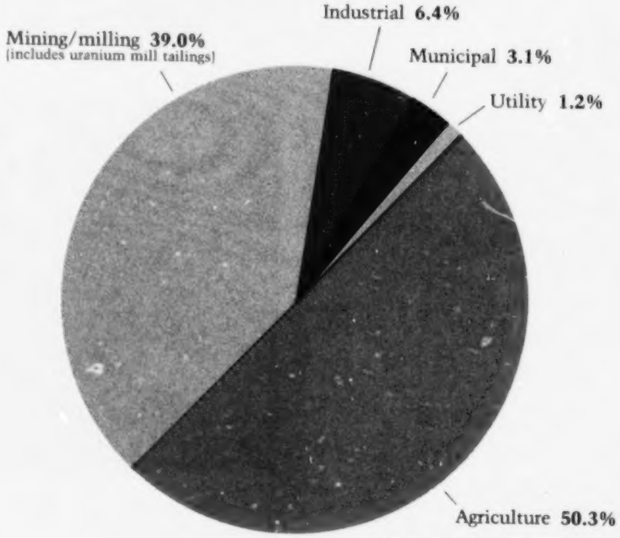
Preceding page blank

AN OVERVIEW

FIGURE L-1

6 BILLION TONS OF SOLID AND HAZARDOUS WASTE ARE GENERATED IN THE U.S. EACH YEAR

(Excludes high-level radioactive waste)



Source: EPA's Office of Solid Waste

More than six billion tons of waste are produced in the United States each year including agricultural, commercial, industrial, and domestic waste. Most waste presents few health or environmental problems. Half the total, for example, is agricultural waste, primarily crop residues, most of which is plowed back into the land. Other waste, particularly that from industrial sources, can imperil both public health and the environment.

If not properly disposed of, even common household wastes can cause environmental problems ranging from producing foul-smelling smoke from burning trash to providing breeding grounds for rats, flies, and mosquitoes. Furthermore, small quantities of toxic substances such as pesticides, paints or solvents may be dumped with household wastes. Even at properly run disposal sites, rain water seeping through the buried wastes may form "leachate," which percolates down and may contaminate ground water. Other organic wastes such as garbage and paper products decompose and can form explosive methane gas.

Industrial wastes may present particularly troublesome problems. Many components of these wastes such as chlorinated hydrocarbons may present serious health or environmental threats by themselves; others are hazardous only in combination with other substances. Potential health effects range from headaches, nausea, and rashes to acid burns, serious impairment of kidney and liver functions, cancer, and genetic damage.

Congress enacted several laws to regulate the generation and disposal of hazardous wastes. These laws are aimed at two basic objectives:

- Proper management and disposal of wastes being generated now and that will be generated in the future.
- Cleanup of sites where the results of past disposal practices now threaten surrounding communities and the environment.

SOURCES OF THE PROBLEM AND EPA's APPROACH

Waste is a seemingly inevitable by-product of virtually all activities people pursue in their daily lives. Every major sector of the economy contributes. Figure L-1 shows the six major sources of the waste generated each year in the United States.

The kinds of wastes produced by these sources and their effects vary greatly. As a result, the various kinds of waste need different levels and types of control. The principal sources of waste and the Federal agencies that control them are discussed below.

Agriculture and Forestry

Of the six billion tons of waste generated each year, half is from agriculture and forestry. The threat posed by most of this waste is relatively small. Much forestry waste is now burned for energy, and agricultural waste is mostly plowed back into fields or burned. Some agricultural wastes, like unused pesticides and empty pesticide containers, do present special hazards and are regulated by EPA.

Mining Wastes

Almost 40 percent of the total waste generated is from mining coal, phosphates, copper, iron, uranium, and other minerals and from ore processing and milling. These wastes consist primarily of "overburden," the soil and rock cleared away before mining, and "tailings," material discarded during ore processing. Although mining wastes are generally considered to present low hazards, they can be a disposal problem because of the large volumes generated. Mining wastes are a major source of environmental problems in most areas with extensive mining activity. Runoff from mining waste increases the acidity of streams and pollutes them with toxic metals. Furthermore, the tremendous overburden generated in surface mining can also pose major local management problems.

Some mine wastes are controlled at the Federal level by the Department of the Interior under the Surface Mining Control and Reclamation Act of 1977. With the exception of specific responsibility for uranium mill tailings, discussed below, under Federal law EPA's primary role is to identify the potential health, safety, and environmental hazards of mining wastes and determine the need for further regulation.

Industrial Wastes

Industries are the major source of hazardous wastes. However, it is not yet fully known what portion of the 400 million tons of industrial wastes generated each year are hazardous. A recent EPA survey of 1981 activities roughly estimated that about 290 million tons of hazardous waste subject to current Federal requirements are generated by industry each year. Although this hazardous waste is generated by the full range of major American industries, the chemical and petroleum industries account for over 70 percent of these 290 million tons.

EPA and the States share responsibility for management of newly generated hazardous waste under the Resource Conservation and Recovery Act (RCRA) — a "cradle to grave" effort covering the generation, transportation, storage, treatment, and disposal of newly generated hazardous waste.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which established the Superfund program, authorizes EPA to act directly to clean up those sites where hazardous wastes from abandoned or inactive waste sites endanger public health, welfare, or the environment. It provides a special fund for cleanup of uncontrolled hazardous sites. A total of $1.6 billion is currently available for that work.

Garbage is dumped in municipal landfills where it is covered with a layer of dirt.

Municipal Wastes

Municipal wastes include household and commercial wastes, demolition materials, and sewage sludge. Solvents and other harmful household and commercial wastes are generally so intermingled with other wastes that specific control of such materials is virtually impossible. Also, "leachate" resulting from rain water seeping through municipal landfills may reach and contaminate underlying ground water.

Although addressed under another provision of RCRA, household wastes are specifically exempted from regulation as hazardous waste. While the degree of hazard presented by this leachate is often relatively low, the volume produced is so great that it is being investigated as a possible contributor to ground-water contamination.

EPA under its program to regulate non-hazardous waste does issue standards and guidance for such facilities. It is then the responsibility of State and local governments to ensure compliance. While most counties and States do regulate municipal landfills, concern for potential contamination of ground water has not been widely evident.

Sewage sludge is the waste material produced by municipal wastewater treatment plants. It is the solid, semisolid, or liquid material that remains after sewage has been treated. Nearly seven million tons of sludge (measured in terms of dry weight) are generated each year.

Due to its volume and potential toxicity, sewage sludge is a major waste management problem in a number of municipalities. Some sewage sludges contain high levels of pathogens or disease-carrying microorganisms, toxic metals, or toxic organic chemicals. Such sludge is regulated as a hazardous waste under RCRA if it is found to be a potential threat to ground-water quality.

Utility Wastes

The principal wastes produced by electric power plants are sludges from air and water pollution treatment processes. Some of these plants also produce radioactive wastes. Under RCRA EPA is primarily responsible for determining whether there is a need to regulate the sludges resulting from air pollution control at these plants. The regulation of radioactive utility wastes is discussed below.

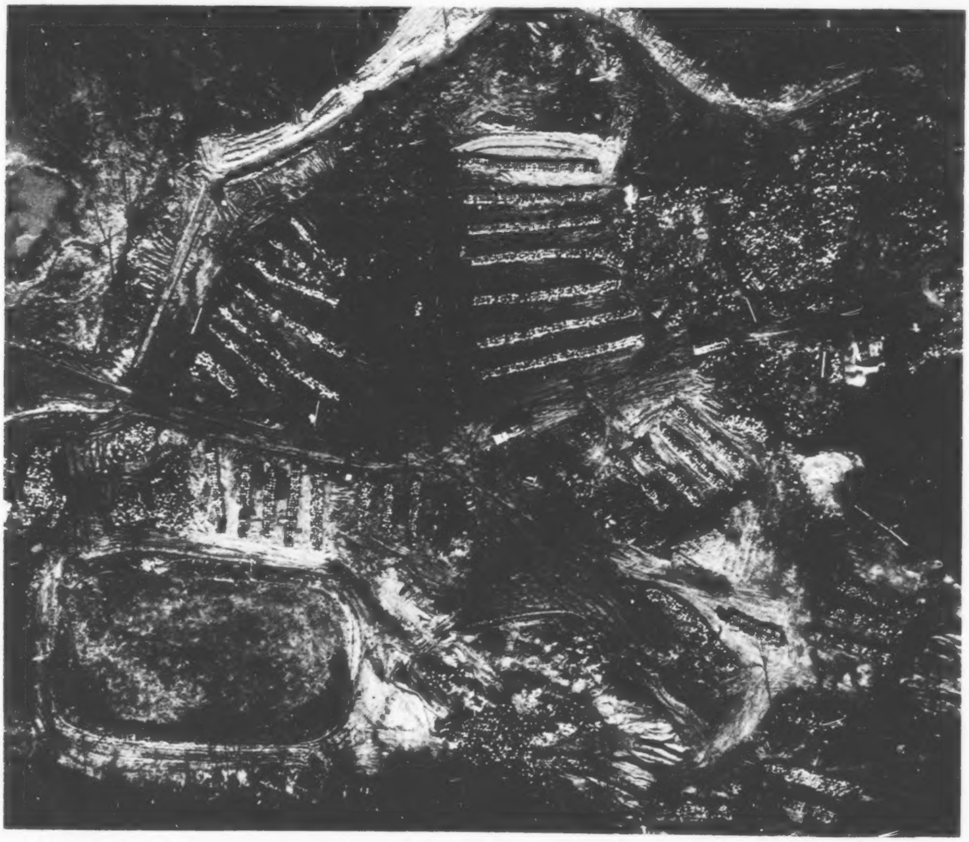
Radioactive Wastes

There are four classes of radioactive wastes.

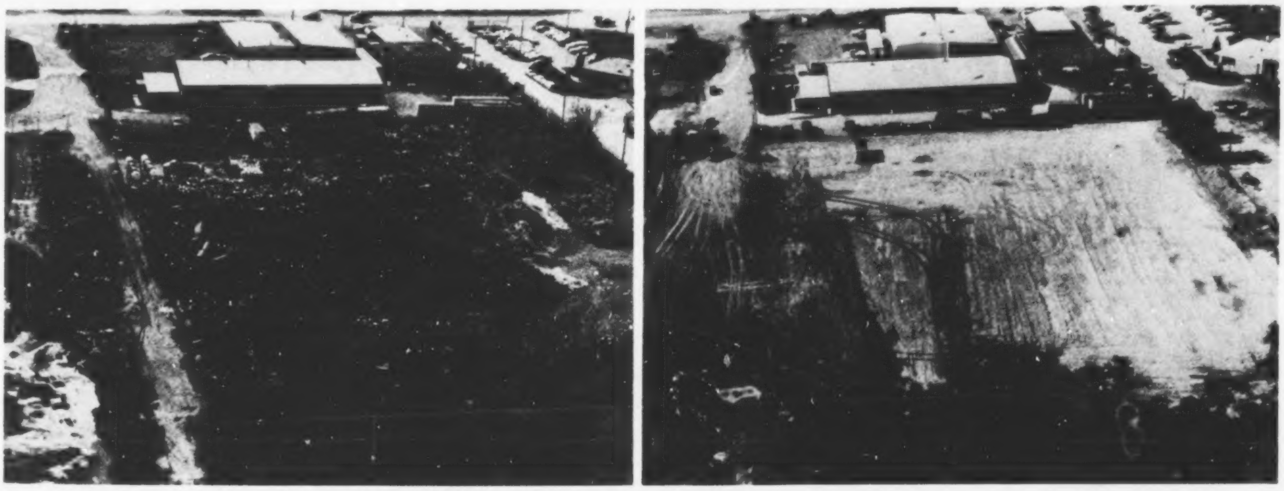
- **High-level radioactive wastes** (HLRW) are generated in nuclear reactors and during nuclear weapons production. These wastes pose a serious threat to anyone who comes near them without shielding.
- **Transuranic wastes** are also generated by nuclear reactors and during weapons production. These wastes contain radioactive metals, such as plutonium, curium, americium, and neptunium. Some are highly toxic and very long-lived. Actual ingestion or inhalation is required for them to produce toxic effects; merely being "exposed" to them is not inherently dangerous. Once inhaled or ingested they can be extremely toxic even in very small amounts.
- **Low-level radioactive wastes** (LLRW) come from a variety of sources, such as hospitals, research labs, and certain industries. These wastes for the most part present a much lower level of hazard. Nevertheless, they can contain some highly radioactive resins from nuclear power plants. Special handling is required since repeated or extended exposure is dangerous.
- **Uranium mill tailings** are a special category of low-level radioactive waste. They vary considerably in degree of hazard and present special problems due to their large volume and because they contain a long-lived isotope of radium.

The Department of Energy, the Nuclear Regulatory Commission, the States, and EPA share responsibility for managing these wastes. EPA sets standards that specify the maximum allowable increase in radiation levels in the environment due to human activity. EPA standards apply to all commercial or governmental organizations that use radioactive material. EPA also proposes guidance to Federal agencies on their use of radioactive materials and their physical handling of radioactive wastes. If adopted by the President, these recommendations take the form of official guidance to these agencies.

In addition, EPA monitors radiation levels in the environment and provides technical assistance to other Federal agencies and to States and local governments carrying out their own radiation programs. EPA also maintains an emergency response capability to monitor accidental releases of radioactive materials such as at the Three Mile Island facility in Pennsylvania.



Aerial view of the cleanup operation at the Valley of the Drums Superfund site in Kentucky where barrels are being recovered and stacked for removal.


The MIDCO I Superfund site in Gary, Indiana before (left) and after (right) removal action.

PROGRESS TO DATE

While EPA's hazardous waste programs are still relatively new, we have made considerable progress towards managing currently generated wastes and cleaning up abandoned or inactive hazardous waste sites. Regulations governing the treatment, storage, and disposal of currently generated hazardous wastes are now in place. States have begun to assume authority for the RCRA program. EPA is accelerating its permitting of land disposal facilities and incinerators and is moving aggressively to enforce interim requirements. EPA has also moved forward in addressing the problems posed by inactive hazardous sites. In the three years since the Superfund program was established, EPA and the States have worked to inventory the extent of the problem across the country and to establish procedures for cleaning up these sites. More than 540 sites are currently included or proposed for inclusion in the National Priorities List. The necessary steps to clean up over 140 of these sites are now underway. As illustrated in the before and after photographs of the MIDCO I site in Indiana, cleaning up one site can be a major undertaking costing millions of dollars.

Abandoned and Inactive Hazardous Sites

Under the Superfund program, EPA and the States may directly initiate action to clean up hazardous sites where timely voluntary cleanup by responsible companies or individuals is not undertaken. Under these circumstances, cleanup costs are paid directly from the $1.6 billion Superfund with a contribution from the State of at least 10 percent. The Government can later sue to recover its cleanup costs from identified responsible parties.

EPA and the States have identified over 17,000 abandoned or otherwise inactive sites that may contain hazardous waste. The total number of identified sites is expected to reach 22,000 by the end of 1985. EPA is now carrying out a multi-step assessment procedure to determine which of these sites actually pose a danger to public health, welfare, or the environment and what cleanup actions are appropriate.

Municipal Wastes and Sludge

State and local governments have the primary responsibility for managing non-hazardous municipal waste so it will present little or no health or environmental problems. The States report to EPA annually on progress in identifying and cleaning up municipal waste sites which do not meet national standards.

Except for situations that present imminent hazards, EPA's role in dealing with non-hazardous municipal waste is more advisory than regulatory. While EPA publishes a national inventory of open dumps identified by the States, the States are responsible for closing or upgrading the identified dumps. EPA also has used its authority to develop national standards for landfill performance and operations, provide criteria for classifying existing land disposal facilities according to their environmental soundness, and issue guidance on development of State waste-management plans and other topics.

EPA has greater direct authority to oversee the management of sludge generated by municipal wastewater treatment plants. Under the Clean Water Act, EPA is developing guidance to States on how to use or dispose of this sludge. EPA will also soon be calling for the establishment of State sludge management programs. The management of municipal sewage sludge, one of our major challenges, is discussed more fully in the next section. (See section on Municipal Sludge.)

Finally, in response to increasing evidence that even leachate from well-run municipal landfills contributes to ground-water contamination, EPA is investigating this potential impact of municipal landfills. (See section on Ground-Water Protection.)

Industrial Hazardous Wastes

The basic approach to managing hazardous wastes under the Resource Conservation

and Recovery Act is to track such wastes from "cradle to grave" through a system of records called "manifests." The manifest system is now in place. Basic requirements governing waste treatment, storage, and disposal have also been established and are being enforced. What remains to be done is to issue final operating permits for hazardous waste facilities and ensure compliance with all the RCRA regulations through a strong enforcement program.

Specifically, EPA and the States are taking steps to ensure that currently generated waste will not result in additional multi-million dollar cleanup problems:

- EPA and the States have taken steps to identify every active hazardous waste facility.

- Regulations setting standards for industries generating hazardous waste and for facilities treating, storing, or disposing of such wastes are now in place. All treatment, storage, and disposal facilities are subject to these "interim status" requirements until they can be issued final permits.

- EPA has begun to issue permits to hazardous waste facilities with priority given to land disposal facilities and incinerators which present the greatest environmental risks. These permits are facility-specific and are more stringent than the interim-status standards.

- EPA and the States inspect these facilities and vigorously pursue enforcement actions as necessary to ensure compliance with interim status and permit requirements. Developing an effective RCRA compliance program is one of EPA's highest priorities. This program will focus first on hazardous waste handlers with significant violations.

Radioactive Wastes

EPA has issued final standards for the control of effluents and emissions from uranium mill tailings during mill operations and for final disposal of these tailings. EPA has also established standards for cleanup and long-term control of uranium mill tailings at the 24 inactive mill sites that qualify for remedial actions under the Uranium Mill Tailings Radiation Control Act.

Environmental standards for high-level radioactive waste disposal are now being finalized. These standards also will apply to transuranic wastes containing high concentrations of radioactive material. Technical analyses to select appropriate standards

Top: Removal of hazardous waste requires great care. Bottom: The Chemical Control Corporation Superfund site before the catastrophic fire.

for disposal of low-level radioactive wastes are near completion. EPA plans to propose the standards later this year.

TODAY'S LAND PROTECTION CHALLENGES

The most important achievement that has been made to address land contamination is that there is now widespread recognition of the major health and environmental problems that may result from indiscriminate dumping of wastes on the land. Such practices in the past have left a legacy of air, ground-water, and surface-water contamination as well as land contamination. Now, for the first time, the Nation is investigating all potentially hazardous sites, and work is under way to clean up the most threatening of these sites. In addition, EPA regulations now provide for environmentally sound management of the millions of tons of hazardous waste newly generated each year. Cooperative efforts by the States and industry are bringing about a dramatic improvement in the management of hazardous waste.

The actual cleanup of past problems, however, has only just begun, and many problems will remain as long-term challenges.

The remainder of this chapter discusses in greater detail the four most significant land pollution challenges faced by EPA, the States, and industry. Other parts of this report also describe problems, such as ground-water contamination, related to the management of wastes on land. The four most significant current land pollution challenges are:

- **Uncontrolled hazardous site cleanup.** One of EPA's highest priorities is the cleanup of the many uncontrolled hazardous sites across the country. EPA's attention is now focused on how to speed up the rate at which these sites are cleaned up without compromising the quality or permanence of these cleanups.
- **Newly generated hazardous waste control.** EPA and the States are taking steps to ensure the proper management of these wastes. They are focusing on major hazardous waste generators and major treatment, storage, and disposal facilities.
- **Radioactive waste disposal.** The safe disposal of high-level and low-level radioactive wastes and the management of uranium mill tailings are difficult long-term problems. Working with other Federal agencies and with the States, EPA has a major role in meeting these environmental challenges.
- **Municipal sludge.** Although sewage sludge is not an environmental threat as serious as industrial wastes and radioactive materials, this sludge often contains hazardous pollutants. Furthermore, it is generated in the greatest quantities in cities and communities with the fewest economically and environmentally acceptable alternatives for its safe use or disposal. As a result, it constitutes a serious environmental management problem.

The order of presentation of these four challenges reflects their relative urgency and seriousness. Many inactive hazardous sites present an immediate hazard to public health and the environment. Identification and cleanup of health hazards at these sites have the highest priority. While safe management of radioactive waste is a major long-term problem, it is ensuring the proper management of other hazardous wastes that is the most pressing current need. Finally, while sewage sludge presents much less in the way of hazard, the problem it does present must be addressed fully and quickly to prevent it from creating inordinate management difficulties for our cities.

Inspection team collecting waste samples from drums at an uncontrolled hazardous site

Uncontrolled Hazardous Site Cleanup

THE PROBLEM

Evidence is mounting that uncontrolled hazardous sites may present some of the most serious environmental and human health problems the Nation has ever faced. In most cases, these sites resulted from hazardous waste disposal with little awareness of the hazards such disposal could eventually pose.

Thousands of abandoned or inactive sites containing hazardous waste have been identified nationwide. Many of these sites are located in environmentally sensitive areas such as floodplains and wetlands. Rain and melting snow seep through the sites, carrying chemicals that contaminate underground waters and nearby streams and lakes. At some sites, the air is also contaminated as toxic vapors rise from evaporating liquid wastes or from uncontrolled chemical reactions. Some pollutants, such as metals and organic solvents, are known to damage vegetation, endanger wildlife, and threaten the health of people who unknowingly drink contaminated waters. For other pollutants, the extent of the danger is not fully known. Information on the health and environmental effects of hazardous wastes comes mainly from laboratory studies of pure chemicals. There still is much to learn about the nature and impacts of the complex mixtures of wastes generally found at these sites.

Most of these sites were created primarily by the chemical and petroleum industries. A smaller number of sites were once municipal landfills that may have become hazardous simply as a result of accumulated pesticides, cleaning solvents, and other chemical products discarded in household trash. A few sites are the result of transportation spills or other accidents. Others are the final resting place of persistent toxic pollutants contained in industrial wastewater discharges or air pollution emissions.

EFFORTS TO DATE

Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), often called "Superfund," in 1980 to address the nationwide problem of uncontrolled hazardous sites.

Under CERCLA, EPA may require that sites be cleaned up by the "responsible parties" who generated or transported the wastes or owned or operated the disposal site. If there appears to be no responsible party able or willing to clean up the site quickly enough, EPA may proceed under the Superfund, a special fund financed mainly by a tax on chemical production. The States must contribute ten percent of the cost of Superfund-financed cleanups. Later, EPA and the States may seek reimbursement by the responsible parties under the "cost recovery" provision of CERCLA.

Starting in 1980, EPA and the States began a concerted effort to identify all uncontrolled hazardous sites. To date, this effort has produced an inventory of over 17,000 potential sites; by the end of 1985, there may be as many as 22,000 sites.

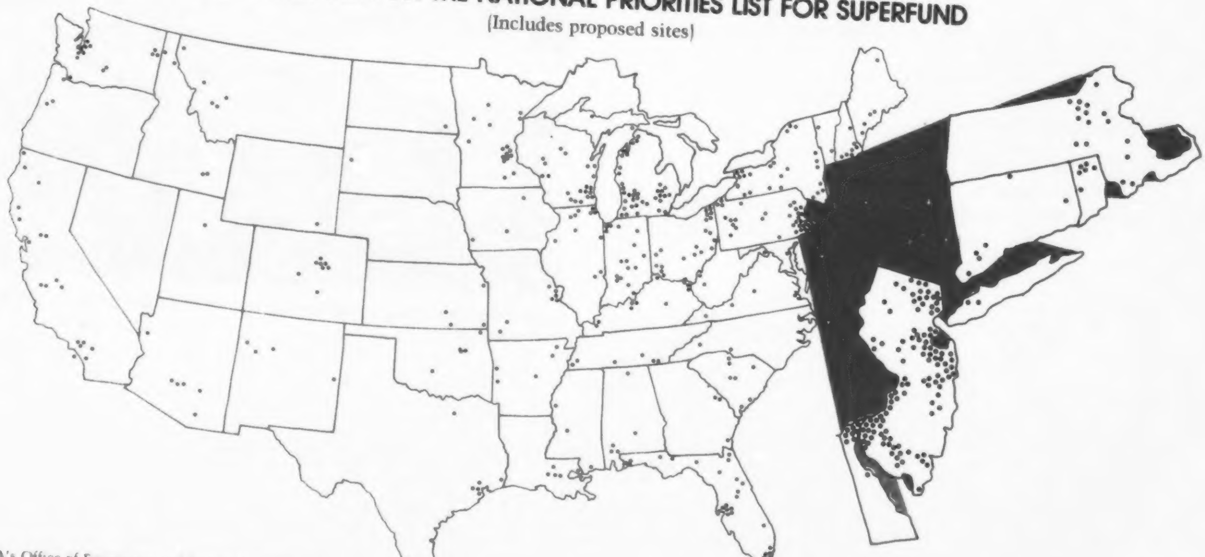
Once identified, these sites are subject to a series of steps to determine whether the sites present a hazard and, if so, what cleanup actions are appropriate. These steps include one or more of the following: (1) preliminary assessment; (2) site inspection; (3) inclusion on the National Priorities List; (4) detailed field sampling (remedial investigation); (5) a decision on how to achieve permanent cleanup; and (6) engineering design and actual cleanup at site (remedial action). Also, an immediate "removal action" can be taken at any step of this process if imminent hazards are found. (See highlight on Cleaning up an Abandoned Hazardous Waste Site.)

Preliminary assessments — the first step in determining if a site poses a threat —

FIGURE L-2

546 SITES ARE ON THE NATIONAL PRIORITIES LIST FOR SUPERFUND

(Includes proposed sites)



Source: EPA's Office of Emergency and Remedial Response have been conducted at 7,300 of the more than 17,000 inactive sites already identified. On-site inspections — more in-depth evaluations of selected sites — have been undertaken at 2,700 sites. EPA plans to complete preliminary assessments at all sites by 1986 and to complete site inspections by 1987.

Of the sites investigated to date, EPA has rated 546 as eligible for inclusion on the National Priorities List (NPL) and thus eligible for long-term remedial action. This list consists of sites across the country where cleanup needs are so serious as to warrant the use of Superfund (Figure L-2). EPA now estimates that eventually some 2,000 sites will be designated as national priorities.

By the end of 1983, removal actions — expeditious cleanup actions to reduce imminent hazards — had been approved for 231 sites. Of these, removal actions have been completed at 185 sites. Longer-term remedial work currently is being planned or is under way for 147 of the 546 sites proposed or currently on the National Priorities List. The bulk of Superfund cleanup activities have been completed at six sites: Chemical Metals (Baltimore, Maryland), Wolcott Chemical Company Warehouse (near Greenville, Mississippi), Luminous Processes (near Athens, Georgia), Butler Tunnel (near Pittston, Pennsylvania), Chemical Minerals (Cleveland, Ohio), and Gratiot County Golf Course (St. Louis, Michigan).

Since December 1981, Federal and State authorities have reached settlements with responsible parties that will result in having these parties spend $277.3 million for cleanups at Superfund sites. To date, Federal and State authorities have also sued responsible parties to recover an additional $17.2 million in cleanup costs initially paid by the Superfund. Such funds, once recovered, will be returned to the Superfund for use at other sites.

In addition to this participation in the activities listed above, States and responsible parties on their own have contained, neutralized, or removed hazardous substances from a number of other sites across the country.

SUPERFUND-FINANCED CLEANUP IN BALTIMORE, MARYLAND

This case study illustrates an all too common scenario that before Superfund could have been an unmitigated environmental disaster. It is the story of a poorly run hazardous waste facility next to a residential neighborhood within an old industrial area. The Chemical Metals Industries site in Maryland is actually two sites in an industrial neighborhood in South Baltimore.

On one site stood a processing plant; on the other was a storage facility. In between were row houses whose residents complained that chemical fumes were so intense they could not open their windows. The sneakers of children who played in the neighborhood were slowly being eaten away by the pooled chemicals.

Chemicals including cyanide, ammonia compounds, acids, caustics, and heavy metal salts were leaking into the ground with each rainfall. EPA officials warned that the chemicals, if mixed, could cause an explosion and fire or could be washed into nearby Gwynn Falls, which drains into Baltimore Harbor. And, when the air around the site was monitored, low concentrations of hydrogen cyanide and other toxic organic vapors were found.

Despite these complaints, Chemical Metals continued to operate its facility without the necessary permits. After one of Chemical Metal's creditors filed a $10,000 suit against the company in April 1981, it was placed in receivership. In a routine inspection of the site in August 1981, a State inspector discovered that the facility had been abandoned.

State officials were concerned with the safety of the residents in the nearby row houses and fearful that more contaminants were stored underground. They called for Federal help. First, the Coast Guard came in on an emergency basis to remove flammable trash and install fences and barriers to absorb the wastes and restrict their spread. Then Maryland designated Chemical Metals its number one priority for a more permanent cleanup.

Contractors hired by EPA removed explosive materials, pumped hazardous wastes from the underground storage tanks, removed contaminated soil and debris, and installed monitoring wells to check for ground-water contamination. By the time the work was finished, over 19,500 gallons of bulk liquids were removed from underground storage tanks and 30,000 pounds of salvageable scrap metal and 1,561 drums were also removed. This cleanup action eliminated all the immediate hazards. None of this would have been possible without the Superfund or similar legislation since Chemical Metals was insolvent.

As required by CERCLA, the State of Maryland then assumed responsibility for monitoring and managing the site. In particular, the State was to ensure that residual subsurface contamination did not contaminate ground water beneath the site. Since that time, it has been discovered that the ground water under the site is contaminated. EPA is now working with the State to assess any hazards that may be associated with this contamination. Fortunately, the site is located in a predominantly industrial area with piped-in water. It therefore appears that no one is now being harmed by the contaminated ground water. However, EPA and the State will continue to follow up to prevent future adverse health or environmental effects from this ground-water contamination.

Reproduced from
best available copy.

THE STEPS IN CLEANING UP AN UNCONTROLLED HAZARDOUS SITE

After someone alerts EPA about an uncontrolled hazardous site, what happens? Here are the highlights from initial telephone call to cleanup.

1.Identification and Preliminary Assessment

A citizen may report half-buried barrels in the neighborhood. A facility manager may send EPA a formal notice. Once EPA learns of a possible hazardous site, all available background information from U.S. Geological Survey maps and EPA, State, and local files is collected. EPA tries to determine the size of the site, the identity of the parties most likely to have disposed of wastes there, the types and quantities of wastes most likely to have been disposed of there, local hydrological and meteorological conditions, and the impact of these wastes on the environment. If it looks as though the site may be a hazard, a site inspection is conducted.

2.Site Inspection

Inspectors on the site collect sufficient information to rank the hazard of the site. They look for 55-gallon drums, dead or discolored vegetation, and other evidence of hazardous waste. Samples of the soil or nearby water may be taken. Inspectors determine the ways hazardous materials could be contaminating the nearby environment, for example by runoff into nearby streams. They check whether children have access to the site and might play there.

3.Ranking Sites for the National Priorities List

Sites are ranked based on the type, quantities, and toxicity of wastes; the number of people potentially exposed; the likely pathways for exposure; the importance and vulnerability of the underlying aquifers; and other factors. The sites with the highest hazard ratings are put on EPA's National Priorities List (NPL).

4.Remedial Investigation

The next step for sites placed on the NPL is a carefully designed field study or remedial investigation. Based on extensive sampling and laboratory analyses, this investigation provides more precise data on the types and quantities of wastes at the site, on the soil type and water drainage patterns, and on the resulting environmental or health threats.

5.Feasibility Study and Cleanup

Cleanup actions must be tailored to each individual site. As part of the feasibility study, EPA identifies alternative cleanup approaches and determines their relative effectiveness and cost.

Longer-term remedial actions are reserved only for sites on EPA's National Priorities List. Remedial actions may include taking the wastes to another site; "capping" the original site with waterproof clay; installing drains, liners, or grout "curtains" to prevent ground-water contamination; providing alternate sources of water; or temporarily or permanently relocating residents.

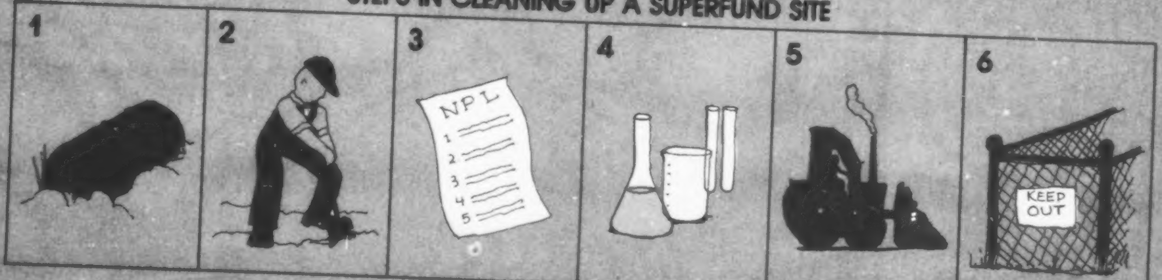
6.Post-Cleanup Responsibilities

After cleanup, the State is responsible for managing the site to prevent future health hazards or environmental damage.

Removal Actions

EPA may also initiate a short-term removal action at any time that a site is found to present an imminent hazard because of the potential for fire or explosions or contamination of a drinking water supply, for example. Removal actions range from installing security fencing to digging up and removing wastes for safe disposal. Such action may be taken at any site, not just those on the NPL.

STEPS IN CLEANING UP A SUPERFUND SITE



TODAY'S CHALLENGES

The cost of cleaning up uncontrolled sites is often very high. Although Superfund can be quickly tapped for emergency cleanup, States have to come up with 10 percent of the costs of permanent cleanups at privately owned sites and 50 percent at publicly owned sites. Some States have not had such funds readily available.

Other States, however, have already set up mechanisms for financing cleanups. A few have established funds for cleanup of sites that are a State priority, regardless of whether they are included on the national list for funding under Superfund. Several others have begun to establish similar legislation.

It normally takes about four years from initial site identification to completion of final remedial action. This process is time consuming for the following reasons:

- When a site is determined to present serious hazards, an on-site, "remedial investigation" is needed. This carefully planned investigation includes sample collection and analysis to identify the nature and quantity of wastes present and an assessment of the terrain, soil type, proximity of underground aquifers, and drainage to nearby surface streams.
- Remedial measures must be carefully designed to ensure that the measures taken will provide long-term protection of public health, welfare, and the environment. Problems at each site are unique, and it is often necessary to develop customized, site-specific solutions.
- There are many participants in a typical Superfund cleanup including government agencies at all levels, responsible parties, and the local community. Because States are required to pay at least ten percent of the actual cleanup cost and to assume full responsibility for post-cleanup costs, EPA must work closely with State officials. EPA also puts high priority on ensuring the involvement of local officials and concerned citizens, especially those who live near the site.

In implementing CERCLA, EPA is concerned with balancing the investment it makes as evenly as possible. In determining the nature of the remedy selected for the site, EPA must balance the potential cleanup costs with the cost of cleanup at all the other NPL sites across the country. The cost of the remedy selected must therefore be "within reason" given the total funds available to pay for cleanup at all NPL sites.

Removal work going on at a Superfund site.

EPA'S AGENDA

For the next two years, the Agency's highest priority is to stabilize and clean up hazardous waste sites under the Superfund program. Accordingly, EPA is committed to accomplish the following:

Complete Identification and Assessment of Uncontrolled Hazardous Sites

The first step in achieving the overall goals of the Superfund program is to complete the identification of the universe of possible hazardous sites by October 1985.

Secure Responsible Action

EPA is speeding up the pace of cleanups in part by pushing for quick resolution of negotiations with responsible parties. EPA is using administrative orders or litigation where necessary to compel cleanup or recover costs already incurred by the Federal Government.

Respond to Immediate Threats

When a responsible party will not agree to act quickly, EPA will take action under Superfund to remove immediate health or environmental risks and seek cost recovery later from the responsible parties. EPA is making an all out effort to take removal actions to stabilize the sites currently on the National Priorities List by October 1985.

Accelerate Remedial Actions

A major thrust of the next few years is to accelerate cleanup of all National Priorities List sites. EPA will take enforcement actions as necessary to secure prompt cleanup by a responsible party or undertake site cleanup financed by Superfund.

Delegation of Authority to Make Site-Specific Decisions

As EPA Regional offices gain operating experience under Superfund, Headquarters is delegating increasing authority to them. While Headquarters must review decisions on the final cleanup actions at each site, many more site-specific decisions will be made at the Regional level. This will contribute significantly to increasing the rate of cleanup.

Newly Generated Hazardous Waste Control

THE PROBLEM

About 290 million tons of hazardous wastes are generated in the United States each year. As we have learned from experience, unless their treatment, storage, and disposal are carefully managed, these new wastes may introduce even more contaminants into our drinking water supplies, release additional toxic vapors, create more explosive dump sites, and otherwise threaten public health and the environment. (See section on Uncontrolled Hazardous Site Cleanup.)

Origin of Hazardous Wastes

Most hazardous wastes result from the production of familiar goods such as plastics, pesticides, medicines, and petroleum products. As illustrated by Figure L-3, the chemical and petroleum industries are responsible for over two-thirds of the hazardous wastes generated.

A small percentage (four percent) of the hazardous wastes generated are recycled. The rest are treated, stored, or disposed of. Most generators treat or dispose of their own wastes. In fact, only four percent of the hazardous wastes generated ever leave the site where they were generated.

Treatment, Storage, and Disposal

Of the hazardous wastes disposed of, most are injected as a liquid into the ground in specially designed injection wells. A large quantity is placed in surface impoundments (pits, ponds, and lagoons). Only a small portion is placed directly on the land or buried (Figure L-4).

Fear of hazardous wastes has made it difficult to gain necessary support from local residents to build even the most environmentally sound new facilities. This, ironically, increases the risk of accidental spills during long-distance transport.

The number of facilities available for management of industrial wastes is shrinking steadily. EPA expects several existing facilities will not continue to operate and take the necessary steps over the next five to ten years to obtain the final permits required under the Resource Conservation and Recovery Act (RCRA). In many areas, the remaining facilities are increasing their capacity in order to meet current and projected needs. Unless there is adequate safe treatment and disposal capacity reasonably close to the generators of waste, the alternatives may be more stockpiling of wastes at industrial sites, illegal storage, and "midnight dumping."

EFFORTS TO DATE

The Resource Conservation and Recovery Act (RCRA) was created in 1976 to minimize the risks from hazardous wastes at all points in their life cycle, from generation to disposal. Thus, under RCRA, EPA and the States have the authority to regulate facilities that generate, treat, store, and dispose of hazardous wastes.

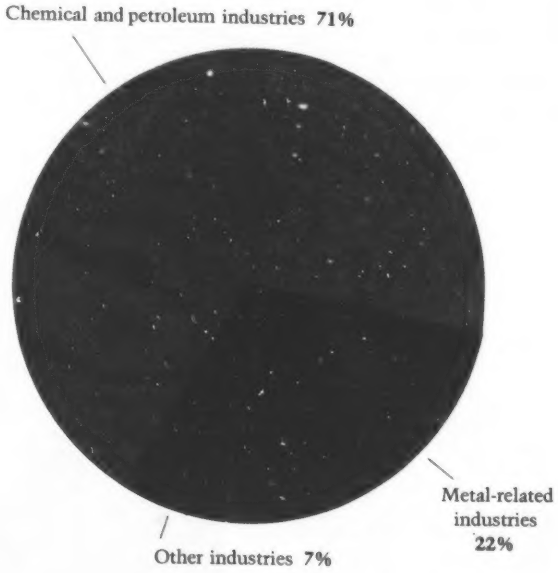
EPA's goals in implementing RCRA are to establish and implement a sound and effective regulatory program and ensure that hazardous waste handlers comply with those requirements.

As a first step, EPA established requirements that must be met by generators and transporters and basic operating requirements called "interim status standards" for treatment, storage, and disposal facilities that were operating before November 20,

FIGURE L-3

MOST HAZARDOUS WASTE IS GENERATED BY THE CHEMICAL AND PETROLEUM INDUSTRIES

(Estimated 1981 figures)



Source: EPA's Office of Solid Waste

1980. Under these standards, operators of hazardous waste landfills, for example, are required to keep thorough records of the types and quantities of wastes disposed of. They also must have staff trained to take emergency measures in case of accidents. Operators must have evidence that they can pay if the public is injured as a result of their operations. In addition, they must be financially able to close the site safely and to monitor and manage the site after closure. While operating the site, they must monitor ground-water quality near the facility and report any contamination to the State or EPA. Finally, they must comply with restrictions regarding the handling of certain types of wastes and waste containers. For example, a liquid waste may not be disposed of directly in a landfill but must first be treated to solidify it.

The second major step was to establish technical or permit standards for the design and safe operation of various classes of treatment, storage, and disposal facilities. These standards are more stringent than the interim status standards and serve as the basis for issuing operating permits that may have additional facility-specific requirements and conditions.

Issuing facility-specific operating permits is the heart of the RCRA program. There are some 4800 facilities that must receive permits. Even relying upon the States to issue a substantial portion of the permits, it may be five to ten years before all facilities receive final permits. As discussed below, EPA has decided both to accelerate the permit process and to focus first on the most environmentally significant permits: those for land disposal facilities and incinerators.

RCRA ENFORCEMENT: TWO CONTRASTING CASE STUDIES

In the last year, EPA has dramatically stepped up enforcement action against poorly designed and operated treatment, storage, and disposal (TSD) facilities for hazardous waste. Two recent enforcement cases in the Pacific Northwest illustrate where EPA has been taking enforcement actions and the need to escalate the actions to convince some facilities that EPA is serious. One case involves a company called Envirosafe Services of Idaho and the other a company called Western Processing.

Initially EPA inspectors found serious design and operational deficiencies at each facility. The inspectors pointed out these problems to the operating staff and followed up with written reports to the facility managers detailing the deficiencies. In both cases, subsequent inspections showed that no significant corrective action had been taken. Consequently, EPA began formal enforcement actions with fines and corrective actions required. The two facilities responded in dramatically different ways.

Envirosafe Services Has Cooperated Fully

In the case of Envirosafe Services, the facility owner agreed to pay the fine and to take corrective actions, including notifying generators that liquid hazardous wastes would no longer be accepted at the facility, digging up containers of liquid waste improperly disposed of, re-containerizing wastes found to be in corroded or otherwise deteriorating containers, and installing ground-water monitoring wells.

The total cost to Envirosafe for taking these corrective actions will be substantial. Nevertheless, the company is moving forward quickly to improve the environmental soundness of its operations.

Western Processing Refused to Comply

The course of events at Western Processing was markedly different. The facility owner refused to pay the fine or to take corrective actions. After fruitless discussions with the facility owner, EPA worked with the Office of the U.S. Attorney and won a court order to close the facility. EPA and the U.S. Attorney have sued the facility owner to ensure that the fine is paid and the site cleaned up. In the process of conducting further investigation for the suit, EPA discovered older portions of the site that were seriously contaminated. EPA has invoked the authority of CERCLA and is now negotiating with several companies that are possible responsible parties for cleanup of these older portions of the site.

Reproduced from
best available copy.

TODAY'S CHALLENGES

Issuing permits for hazardous waste operations presents a considerable challenge for EPA and States for a number of reasons. First is simply the sheer number of permits that must be issued. Even if the estimate of 4800 is off by a significant margin, the work load is staggering. A second reason is the technical and legal complexity of the task. Thorough assessments of each site are needed in order to develop operating requirements for the permit. Specialists trained in engineering, hydrology, and chemistry are often needed to determine the risks involved and develop site-specific permit conditions to minimize them.

At the same time, today's permit decisions set legal precedents, and careful legal review is required before making these decisions. Once a precedent is set, decisions in similar situations can be fully delegated to program managers in EPA's Regional offices and in the States.

Experience to date is that most initial permit applications are incomplete and require several rounds of review and revision. This obviously slows the rate at which permits can be issued and further complicates the task. Finally, in many cases, State agencies issuing these permits also run other environmental programs. In many cases persons responsible for issuing final permits also are responsible for ensuring compliance with interim requirements. In some States the same staff issues both RCRA and water permits. The lack of enough skilled permit writers has been a serious problem.

Difficult policy issues have arisen as well. Some treatment, storage, and disposal facilities have elected to close or to stop handling hazardous wastes in order to avoid the stringent new requirements. While this may weed out some problem sites, it may also reduce existing hazardous waste disposal capacity in some areas at a time when new facilities are difficult to establish.

New requirements for handling, transporting, treating, storing, and disposing of hazardous wastes have increased the cost to generators of disposing of such wastes. For the long term, high costs create an incentive to increase recycling and reduce waste generation. In the short term, however, they may lead to longer storage at industrial sites, illegal storage, and "midnight dumping."

In addition to these difficulties, a number of scientific and technical problems remain. Little is known about the ultimate fate and effects of many hazardous wastes in the environment, making it difficult to know what control measures should be required. For example, if a substance is very persistent and is taken up by fish and other animals, it may have serious long-term toxic effects and should be controlled accordingly. For most substances, however, we do not have complete information on persistence or toxicity.

To compound the problem, continued growth in the manufacture and use of chemicals may increase the volume and variety of hazardous wastes. In addition, growth in light, "high-tech" enterprises may disperse the hazardous waste problem among many more small facilities using a greater variety of chemicals. We now realize that some facilities now exempt from EPA requirements may pose problems. Examples include small-quantity generators and municipal landfills where small amounts of hazardous waste mingle with trash and garbage.

Finally, the state-of-the-art of hazardous waste control is not well advanced. For example, there is growing evidence that even the most technically sophisticated synthetic liners may not permanently seal hazardous wastes in landfills. EPA has therefore put considerable emphasis on research to develop new treatment methods to destroy, neutralize, or detoxify hazardous wastes that cannot be recovered and reused economically. Once developed and successfully demonstrated, such treatment methods would be available as alternatives to land disposal.

EPA'S AGENDA

Two of EPA's highest priorities are to expedite the permitting of land disposal sites, incinerators, and other major hazardous waste facilities, and to ensure compliance by hazardous waste handlers with regulations under RCRA. Working with the States to achieve those objectives is critical to avoiding the serious environmental consequences of improper handling and disposal of hazardous wastes.

Accelerated Permitting

EPA and the States are committed to issue site-specific permits (to replace interim status requirements) as expeditiously as possible. Beginning in 1984, a new strategy involves calling on facilities to submit applications on an accelerated schedule. The strategy will emphasize permits for the most environmentally significant facilities. Accordingly, land disposal and incinerator facilities will be addressed first. To help expedite the permit process, EPA and the States will give operators advanced notice of modifications in design or operations likely to be called for in their permit. Specifically, EPA and the States will inspect facilities and counsel facility managers on what is needed for a permit for that facility and how to prepare an application. Trade associations will also be encouraged to help members submit complete applications. At the same time, EPA and the States will begin to seek monetary penalties from facilities submitting late or incomplete applications.

EPA will also speed up the permitting process by fully delegating more permit decisions to States and EPA Regional offices, especially once key precedent-setting decisions have been made.

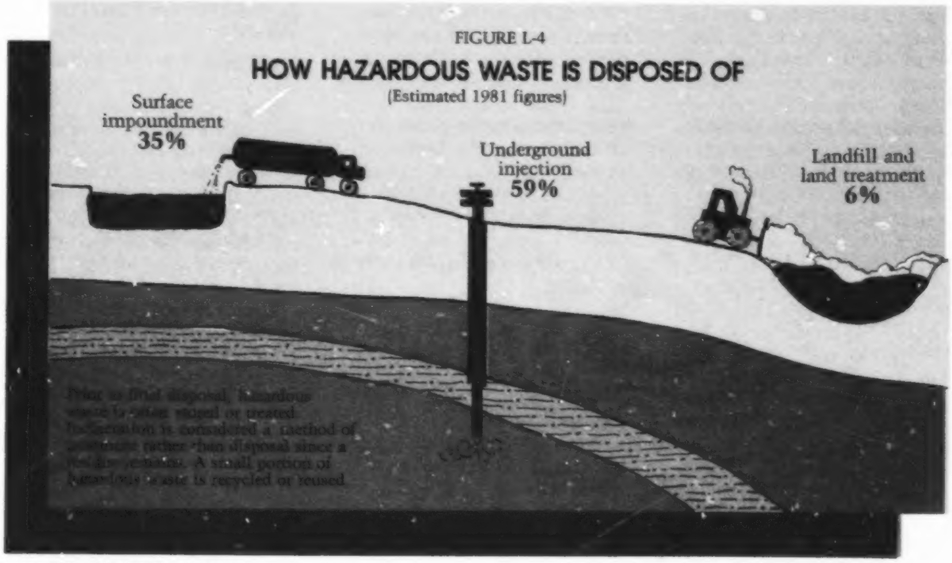


FIGURE L-4

HOW HAZARDOUS WASTE IS DISPOSED OF

(Estimated 1981 figures)

Prior to final disposal, hazardous waste is often stored or treated. Incineration is considered a method of treatment rather than disposal since a residue remains. A small portion of hazardous waste is recycled or reused.

Source: EPA's Office of Solid Waste

Improved Compliance

An extremely important priority for RCRA is to achieve a high level of compliance by major hazardous waste handlers with RCRA regulations. In particular, EPA and State enforcement officials will focus on requirements for ground-water monitoring, closure and post-closure plans, and financial responsibility requirements. Under the latter requirements, facility operators must demonstrate that they have an adequate source of funds to pay for closure and post-closure care as well as to pay damages in the event of harm to the public.

Significant violations of these and other RCRA regulations will bring immediate enforcement action by EPA and States. To ensure continued compliance, States and EPA conduct comprehensive inspections of both newly permitted and interim-status facilities. In the next few years, EPA will work jointly with the States to place special emphasis on compliance monitoring and enforcement programs.

Expanded State Role

Implementation of RCRA is premised on a strong and effective EPA/State partnership. EPA will continue to help States develop programs so they can assume responsibility for regulation of generators, transporters, treatment, storage, and disposal facilities. EPA's primary role will be to provide technical guidance and to oversee and evaluate State programs to ensure consistent, effective implementation of the law. At the same time, EPA will act directly to enforce RCRA where it deems such action necessary to supplement State enforcement activities. This combination of State enforcement responsibility backed up where necessary by EPA will ensure that the requirements of the law are met by all facilities covered by the RCRA program.

Other Current Initiatives

EPA is also working to improve the effectiveness of the hazardous waste program by focusing on the following needs:

- **Improved monitoring.** Monitoring the generation, handling, and disposal of hazardous wastes will help EPA tell whether wastes are being properly disposed of or not. EPA's first national report on the generation and disposition of hazardous wastes will be issued in 1985. EPA and the States will then focus enforcement efforts on any types of wastes or industries for which there are indications of significant patterns of unauthorized disposal.
- **Prosecute illegal dumpers.** Administrative enforcement actions play a much larger role in RCRA than does judicial enforcement. Nevertheless, more than 15 cases of illegal dumping of hazardous wastes have been referred to the Department of Justice for prosecution, and additional cases are now under investigation. EPA and the States will continue to take vigorous action when instances of illegal dumping are discovered.
- **Assess current exemptions.** EPA will reassess the significance and impact of activities now exempt from Federal regulations such as mining or generating only "small quantities" of waste. Where appropriate, EPA will modify existing regulations. In 1983, EPA tightened rules for facilities that recycle hazardous wastes or use them as fuel.
- **Promote better ways to deal with hazardous wastes.** While EPA is conducting research to make landfills more secure, safer alternatives to land disposal of hazardous wastes are needed. EPA is now sponsoring research on promising new treatment processes to destroy, incinerate, or detoxify wastes. In addition, several industries are developing ways to recover and reuse hazardous by-products to reduce the volume of hazardous waste requiring treatment or disposal.

LAND

Radioactive Waste Disposal

THE PROBLEM

Since the early 1900's, the United States has made significant use of radioactive materials and as a consequence has generated large quantities of radioactive wastes. When handled improperly, these wastes can present serious public health and environmental threats that sometimes last many generations. Radioactive materials may emit dangerous levels of radioactivity for hundreds or even thousands of years. Exposures to high levels of radioactivity can result in acute health effects; high enough levels can result in death within hours. Smaller doses are known to cause cancer and genetic damage. The combination of its longevity and life threatening effects makes proper disposal of radioactive waste imperative.

High-Level Radioactive Wastes

Spent fuel elements from nuclear reactors contain highly concentrated radioactive materials. If this fuel is reprocessed to recover uranium and plutonium, much of the remaining radioactive material goes into the liquid wastes generated during this reprocessing. As of 1981, about 11,000 cubic feet of spent fuel and 77,000 cubic feet of reprocessing wastes have accumulated. These materials are currently stored at the facilities where they were generated or at special sites such as locations near West Valley, New York; Aiken, South Carolina; and Morris, Illinois. The primary commercial source of these wastes, the nuclear reactors operated by the Nation's electric utilities, are currently generating about 1,600 cubic feet of spent reactor wastes (spent fuel) each year.

High-level radioactive waste (HLRW) is also generated during nuclear weapons production and through the use of nuclear reactors to power naval vessels. The present inventory of defense-related HLRW stands at about ten million cubic feet and is presently stored at three Federal facilities located at Richland, Washington; Aiken, South Carolina; and Idaho Falls, Idaho.

The radioactive materials found in HLRW emit several kinds of radiation including gamma rays which are highly penetrating. These materials can, therefore, produce harmful effects without having to enter an organism by ingestion or inhalation. Many of these materials remain radioactive for thousands of years.

Transuranic Wastes

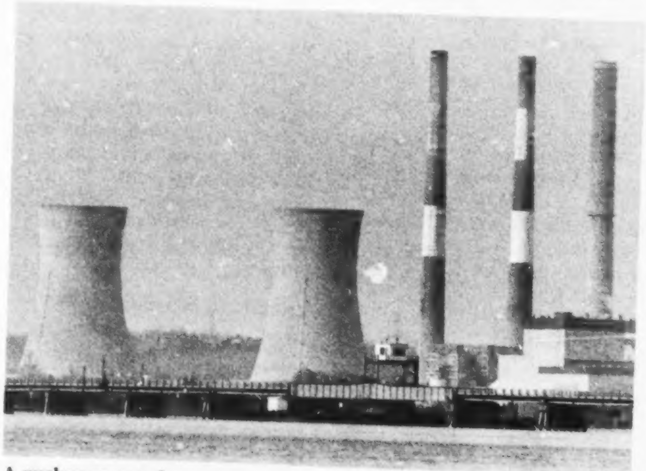
Transuranics are those relatively few elements that are heavier than uranium such as plutonium, americium, curium, and neptunium. While some transuranic wastes are produced in nuclear reactors, the primary source is the production of nuclear weapons. Transuranic wastes generally emit a form of radiation called alpha particles that do not easily penetrate materials or living tissues. Transuranics are therefore usually only damaging as a result of ingestion or inhalation. Once in the body, however, transuranics prove extremely toxic. Furthermore, several transuranics, including plutonium, also maintain their radioactivity for extremely long periods of time, with half-lives of thousands of years.

There are about 1,900 kilograms of transuranic elements contained in about 13 million cubic feet of national defense-related waste at various sites operated by the U.S. Department of Energy (DOE). Beginning in 1988, a large amount of these existing wastes and newly-generated transuranic wastes will be placed at the Waste Isolation Pilot Plant (WIPP), which will be operated by DOE at Carlsbad, New Mexico.

Low-Level Radioactive Waste

Examples of low-level radioactive wastes (LLRW) include radiopharmaceuticals; laboratory clothing from hospitals or research facilities involved in nuclear medicine; tools used in cleaning up radioactively contaminated areas; and materials filtered from nuclear reactor cooling systems. Some small quantities of transuranic wastes are also treated as LLRW. In general, LLRW contains much less radioactivity per unit of weight than does HLRW.

By 1981 130.6 million cubic feet of civilian LLRW had been buried at 6 commercial sites and 57.2 million cubic feet of governmental LLRW at 17 DOE sites. About 3.1 million cubic feet of LLRW is currently being produced by private industry each year with about 2.0 million



A nuclear power plant

cubic feet by government operations. There are currently only three operating commercial waste sites for such materials, all licensed by the host States acting under agreements with the Nuclear Regulatory Commission (NRC). These are located at Richland, Washington; Barnwell, South Carolina; and Beatty, Nevada.

Eventually, radioactive facilities wear down or become obsolete and must also be disposed of. Currently operating commercial, military, and research reactors are expected to be in service no longer than 40 years. It will then be necessary to dispose of them in an environmentally sound manner. Nuclear components of reactor-driven naval vessels, most of them submarines, must also eventually be disposed of appropriately.

Uranium Mill Tailings

Uranium ore has been mined in significant quantities in the United States for over 30 years with 27 mines currently in operation. Tailings, produced when uranium is extracted from the mining ore, contain small concentrations of radioactive materials such as radium and thorium and emit radon, a radioactive gas. In addition to an estimated 183 million tons of tailings already produced, an equal amount may be generated by the turn of the century. Because they normally contain relatively small amounts of radioactivity per unit volume, uranium mill tailings constitute a special class of low-level radioactive waste.

EFFORTS TO DATE

EPA shares responsibility for radioactive waste management at the Federal level with the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE). The NRC has direct regulatory authority over commercial nuclear activities, and DOE oversees government nuclear activities including both energy and nuclear weapons production. EPA issues radiation standards that set limits on human radiation exposure levels or on quantities or concentrations of radioactive materials that may be released to the environment. Once issued, EPA standards apply to all commercial and most governmental operations. EPA also develops recommendations for Federal guidance for radiation protection that applies only to Federal agencies that handle radioactive materials.

In addition, EPA provides technical assistance to other Federal agencies and to State and local governments for carrying out their radiation protection programs. EPA also monitors radiation levels in the environment both on a regular basis and on an emergency basis in the event of major accidental releases of radioactive materials.

TODAY'S CHALLENGES

The basic challenge for EPA in environmental radiation management is to establish what level of radiation exposure is acceptable for the protection of human health and the environment. EPA manages its radiation activities on the premise that any exposure to radiation carries some risk, with the risk increasing as exposures increase. In determining at what levels to set standards or provide Federal Guidance recommendations, EPA takes into account technological, social, and economic factors to reduce risks to reasonable levels. In accordance with this approach, EPA has established standards for a number of sources disposing of radioactive waste.

In January 1983, EPA established standards for cleanup and long-term control of uranium mill tailings at the 24 inactive mill sites that qualify for remedial actions under the Uranium Mill Tailings Radiation Control Act. Two types of remedial actions are required: cleanup of tailings that have spread from the original site or have been removed for use elsewhere and disposal of tailings to ensure their environmentally sound, long-term stabilization. These remedial actions are being carried out by DOE and affected States, with the concurrence of the NRC. In September 1983, EPA issued final standards for the control of effluents and emissions from uranium mill tailings during mill operations and for the final disposal of these tailings. The standards require disposal of tailings so that possible health hazards will be controlled and limited for at least 1,000 years.

EPA'S AGENDA

High-Level Waste

EPA is now developing environmental standards for HLRW disposal. These standards will also be applicable to transuranic wastes containing high concentrations of radioactivity. The proposed HLRW environmental standard would require containment of radiation wastes so that potential health impacts to the U.S. population for the next 10,000 years are not more than 1 additional cancer every 10 years. For comparison, the natural background radiation levels currently cause more than 3,000 fatal cancers every year in the United States.

Low-Level Waste

Work to provide a technical basis for LLRW environmental protection standards has been under way at EPA for several years. EPA plans to propose these standards this year. For commercial sites, standards for LLRW disposal will eventually be implemented and enforced directly by the NRC through its licensing requirements or by individual States having regulatory agreements with the NRC. For Federal Government disposal facilities, DOE will implement the EPA standards.

Decommissioned Facilities and Equipment

EPA is initiating work to develop background information concerning permissible levels of residual radiation and acceptable procedures for decontamination of sites, buildings, and equipment at nuclear reactor facilities and research laboratories that will soon be reaching the end of their useful lives. This information could then be used in either recommending Federal Guidance or promulgating standards. In the spring of 1985, EPA will decide which of these options to pursue.

LAND

Municipal Sludge

THE PROBLEM

Sludge is the by-product of most air and water pollution control processes, including the treatment of sewage. While sludge from municipal water treatment processes does not usually present a major threat to health or the environment, it often poses a major environmental management problem.

Sludge can be an extremely diverse material — biologically, chemically, and physically — and it varies substantially among treatment plants serving different communities and over time within individual treatment plants. Some sludges may be hazardous and require special handling, while others are sufficiently innocuous to be used as a livestock feed supplement. Not only are sludges themselves highly variable, but their potential environmental effects are also closely tied to both site-specific factors — soil type, climate, local vegetation — and to the manner in which sludges are locally disposed of or used.

It is estimated that nearly 7 million dry metric tons of municipal sludge are generated annually by the Nation's 16,000 municipal sewage treatment plants. A small fraction of the plants produce most of the sludge (Figure L-5). Options for the use of municipal sludge include use as a fertilizer or soil conditioner; in energy generation (methane gas production or combustion in heat recovery systems); or as a construction material. Disposal alternatives include disposal on land (including landfills and land treatment processes), incineration, and ocean dumping. Today about one-half of municipal sludge is applied to or disposed of on the land, one-quarter is incinerated, and the rest is put in surface impoundments, stored, or dumped in the ocean (Figure L-6).

Sludge is generated in the greatest quantities in those cities with the fewest economically and environmentally acceptable options for dealing with it. In many of these cities, air quality problems can mean that incineration of sludge must be tightly controlled or cannot be permitted at all. Even if the levels of toxic contamination are acceptable, land for landfilling or surface application is often only available at great distances from the treatment plant or across political boundaries, making access difficult. Because of the difficulties presented by incineration, land disposal, and ocean dumping, many cities are investigating options for making productive use of sludge.

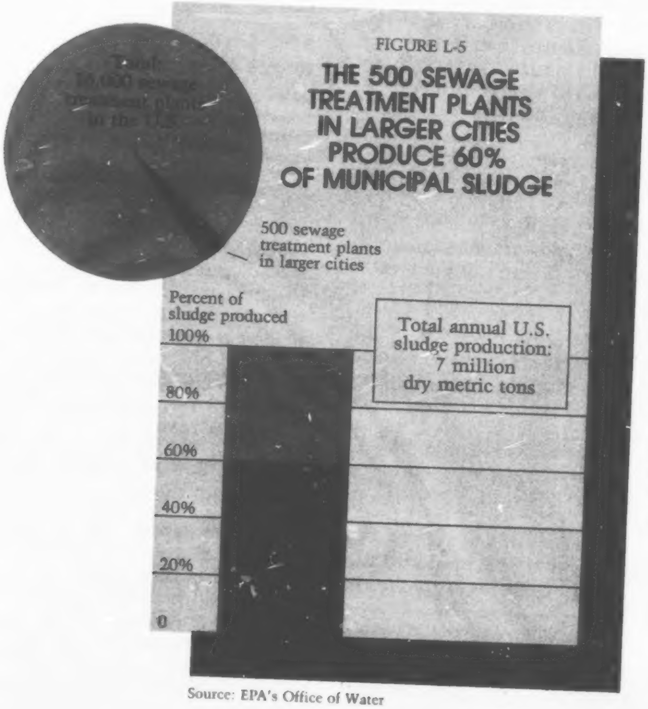


FIGURE L-5

THE 500 SEWAGE TREATMENT PLANTS IN LARGER CITIES PRODUCE 60% OF MUNICIPAL SLUDGE

Source: EPA's Office of Water

EFFORTS TO DATE

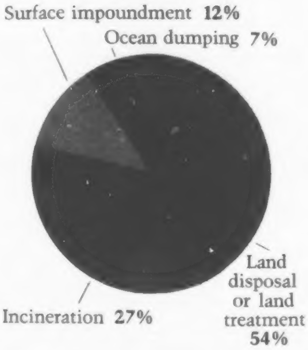
At least five different Federal laws address various aspects of the municipal sludge management problem. Principal among them is the Clean Water Act (CWA). To ensure the disposal of municipal sludge in a manner that would protect the Nation's waters, the CWA specifically addresses the management of sludge by:

- Requiring EPA to issue regulations on the use or disposal of municipal sludge;
- Requiring local governments to have responsibility for sludge management and to institute programs for the pretreatment of industrial discharges to their sewers to reduce the amounts of toxic contaminants; and
- Providing, under the construction grants program, funds for constructing sludge treatment processes as well as wastewater treatment processes at municipal sewage treatment plants. A significant portion of the construction costs of a sewage treatment plant now go to facilities and equipment for sludge processing, utilization and disposal.

The disposal of municipal sludge on land is also subject to regulations for waste sites developed under the Resource Conservation and Recovery Act (RCRA). Criteria establishing guidelines for sludge disposal at waste sites have been implemented jointly under RCRA and CWA authorities. Criteria have also been developed for the use of municipal sludge as a soil conditioner. RCRA regulations for the management of hazardous wastes are applied to municipal sludge disposal in those relatively few cases where sludges have been found to meet the RCRA hazardous waste criteria (e.g., because of high concentrations of toxic metals).

FIGURE L-6

WHAT WE NOW DO WITH MUNICIPAL SLUDGE



Source: Municipal Environment Research Laboratory, Cincinnati, Ohio, USEPA

The incineration of municipal sludge must also comply with the Clean Air Act's (CAA's) regulations for hazardous air emissions and performance standards for new sludge incinerators, where applicable. They must also be accounted for in State Implementation Plans for meeting ambient air standards for criteria pollutants. (See Air Overview.)

The ocean disposal option for sludge management is only used by a limited number of cities. The number of companies and cities engaging in ocean dumping declined dramatically in the late-1970's as a result of regulations oriented toward phasing out such practices by 1981. Although the number of ocean dumpers declined, the amount dumped by the largest remaining dumpers increased, with the net result that the total amount dumped increased. A court order in 1981 rescinded the coming deadline for a ban on ocean dumping and required EPA to reconsider the environmental and economic impacts of alternatives such as land disposal prior to eliminating the ocean disposal option.

TODAY'S CHALLENGES

Management of municipal sludge continues to be a difficult problem, particularly for a number of cities with limited use or disposal options. Management of sewage sludge has complicated and increased the cost of the operation of sewage treatment plants.

A major barrier to proper management of sludge is the fragmented and uncoordinated regulatory structure at both the Federal and State levels of government. At the Federal level, regulations developed under five major laws directly involved with sludge management have been fashioned independently. As a result of this fragmentation, present Federal regulations are both uneven in their stringency and incomplete in their coverage. The same is true at the State and local level. As a consequence, sludge use and disposal programs, reflecting differences in Federal, State, and local objectives and concerns, present a bewildering array of often conflicting objectives.

Another frequent barrier is the presence in some cities of toxic chemicals in the municipal sludge they produce. Much of this contamination results from the discharge of inadequately treated industrial wastewater into the cities' sewers. When contaminated in this way, the potential for using the sludge as a soil conditioner is greatly reduced. The sludge ceases to be a potentially revenue-generating resource and instead becomes a major, resource-draining disposal burden.

EPA'S AGENDA

EPA's agenda will be guided by a Policy on Municipal Sludge Management to be issued in the Summer of 1984. Given the complexity and variability of sludges and local situations, it is EPA's position that any effective regulatory framework must provide for substantial decision making at the State and local level. Many States have already demonstrated considerable initiative and ability in regulating sludge and often provide needed assistance to local government. Some Federal involvement, however, is needed to help ensure that effective sludge management programs are developed and implemented by all States and local governments needing them. EPA's strategy calls for the following:

Coordinate All Federal Regulations Pertaining to Sewage Sludge

As a first step, EPA intends to build an integrated, comprehensive Federal regulatory structure for sludge disposal and use. EPA will consolidate regulations where appropriate and develop new regulations where important gaps remain.

Improve Sludge Quality Through Pretreatment

The "pretreatment program" requires industries to remove certain pollutants from their wastewater before discharging it into municipal sewers. Since municipal sewage treatment plants are not designed to treat adequately all forms of industrial wastes, some pollutants remain after processing at a municipal treatment facility. These remaining pollutants end up in the sludge produced by the municipal plant. To protect water quality and reduce sludge contamination, EPA has established national standards for industrial pretreatment of toxic metals and organics in wastewater before it enters municipal sewers. EPA will continue work with States and local governments to develop and implement local pretreatment programs consistent with standards.

Issue Federal Standards for the Reuse and Disposal of Municipal Sludge

The Agency has initiated a major effort to publish Federal standards for each possible use or disposal alternative for sludge. These standards will specify the maximum acceptable contaminant levels for each use or disposal method. EPA intends to revise or develop regulations for land application, landfilling, incineration, and ocean dumping as well as distribution and marketing of sludge for soil conditioning. These regulations will provide adequate protection for public health and the environment while promoting the beneficial resources of municipal sludge.

Require Each State to Develop a Sludge Management Program

The Agency will develop regulations requiring each State to develop a sludge management program to integrate disparate State regulations and programs concerning sludge management. EPA will describe the minimum objectives a State program must meet while allowing each State to design a program best suited to its needs.

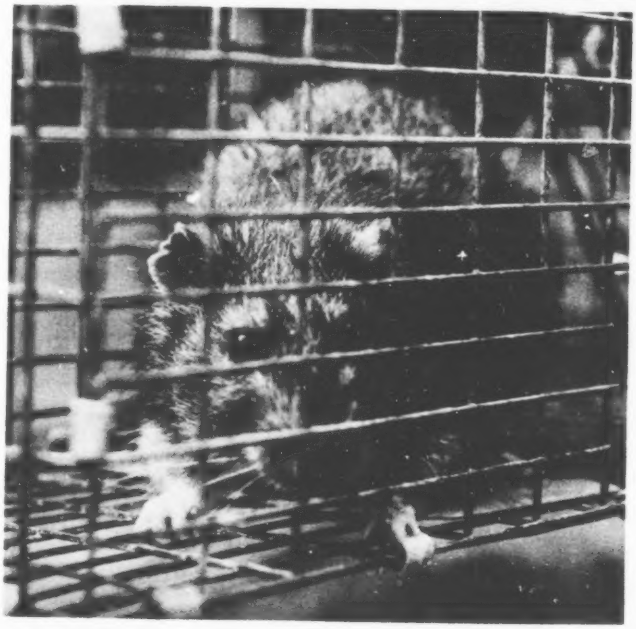
Provide Technical Guidance

EPA will continue to provide technical information and guidance on sludge management to supplement the sludge management regulations. General guidance will be completed in August 1984. In addition, EPA will maintain an active center for public information and education.

TOXIC CHEMICALS

Preceding page blank

TOXIC CHEMICALS



More than 60,000 chemical substances are manufactured in the United States for use in an almost unlimited number of products. The benefits derived from such extensive use of chemicals are significant. However, we now know that a number of chemicals may cause cancer, birth defects, reproductive failures, and other irreversible effects. Exposures to these substances have serious health and environmental consequences that must be addressed. Examples include:

- Extensive exposure to asbestos in numerous buildings where this cancer-causing substance has been used for insulation and fire-proofing;
- Contamination of harbors, lakes, and rivers with polychlorinated biphenyls (PCBs) that accumulate in fish and shellfish;
- Buildup of persistent pesticides such as DDT, aldrin, and chlordane in the tissues of people and wildlife as the pesticides are passed through the food chain; and
- Ground water contaminated by pesticides and toxic substances that leach readily in many soils.

As described in earlier sections of this report, EPA is controlling exposure to toxic chemicals by regulating air emissions, water discharges, and the disposal of chemical wastes on the land. This chapter discusses EPA's alternative, "front-end" approach which can ban or restrict the manufacture and use of new and existing chemicals to prevent or remove any unreasonable risks that a substance may pose to human health or the environment. This is EPA's general approach to the control of both commercial chemical substances under the Toxic Substances Control Act (TSCA) and pesticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

This chapter begins with an overview of this approach and the progress EPA has achieved in addressing the unreasonable risks of toxic substances and pesticides. The remainder of this chapter presents in more detail some of the challenges we face today and EPA's response.

Preceding page blank

AN OVERVIEW

People have long recognized that sulfuric acid, arsenic compounds, and other chemical substances can cause fire, explosion, or poisoning. Although accidents and misuse of chemicals continue to occur, we have learned to handle chemicals to minimize these hazards. More recently, we have become aware that many chemical substances such as benzene and a number of chlorinated hyrdocarbons present potential risks of cancer, birth defects, and other chronic health effects. More often than not, however, determining which chemical substances will cause harmful effects under what circumstances is shrouded by uncertainty.

Often chronic health effects can result only after long-term exposure to toxic chemicals. In other cases, such effects may develop many years after a single exposure. Furthermore, these toxic substances can work together or in combination with other substances such as those in cigarette smoke to greatly increase the likelihood of chronic health effects. We understand little about the synergistic effects of these substances.

Since its inception, EPA has had regulatory responsibility for pesticides under the 1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This law has been amended to encompass all pesticides used in the United States and requires a balancing of a pesticide's benefits against its health and environmental risks. In 1976 Congress passed the Toxic Substances Control Act (TSCA). This new legislation has given EPA the tools to identify and control unreasonable risks

FIGURE T-1

MAJOR TOXIC CHEMICAL LAWS ADMINISTERED BY EPA

Statute	Provisions
Toxic Substances Control Act	Requires that EPA be notified of any new chemical prior to its manufacture; authorizes EPA to require chemical testing information from manufacturers; and gives EPA authority to regulate production, use, or disposal of a chemical as necessary.
Federal Insecticide, Fungicide and Rodenticide Act	Authorizes EPA to register all pesticides and specify the terms and conditions of their use, permit unregistered uses in certain circumstances, and remove unreasonably hazardous pesticides from the marketplace.
Federal Food, Drug and Cosmetic Act	Authorizes EPA in cooperation with FDA to establish tolerance levels for pesticide residues on food and food products.
Resource Conservation and Recovery Act	Authorizes EPA to identify hazardous wastes and set standards for their generation, transportation, treatment, storage, and disposal.
Comprehensive Environmental Response, Compensation and Liability Act	Requires EPA to designate hazardous substances that can present substantial danger and authorizes the cleanup of sites contaminated with such substances when there is an imminent and substantial danger.
Clean Air Act	Authorizes EPA to set emission standards to limit the release of hazardous air pollutants.
Clean Water Act	Requires EPA to establish a list of toxic water pollutants and set standards.
Safe Drinking Water Act	Requires EPA to set drinking water standards to protect public health from hazardous substances.
Marine Protection Research and Sanctuaries Act	Regulates ocean dumping of toxic contaminants.

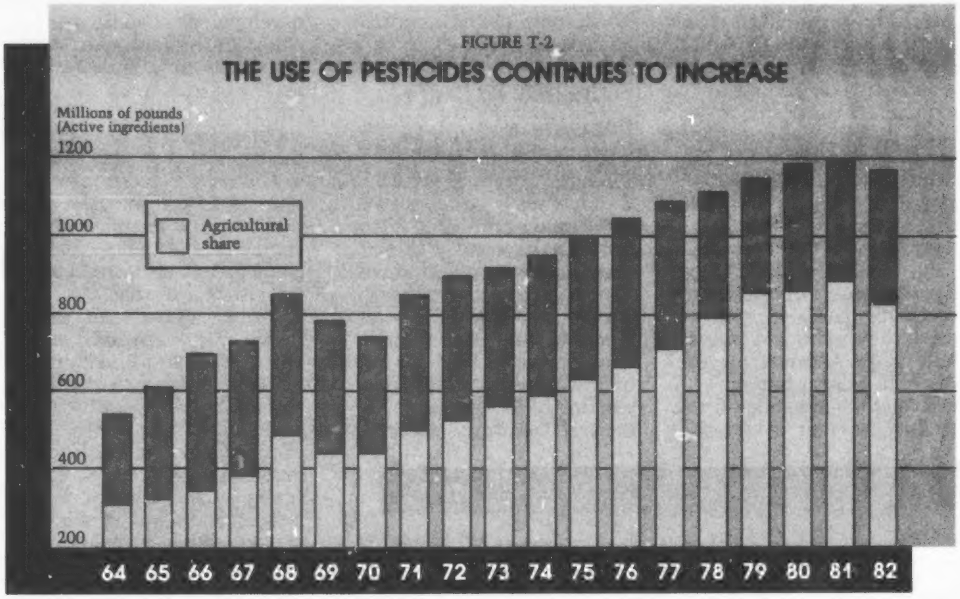


FIGURE T-2

THE USE OF PESTICIDES CONTINUES TO INCREASE

Source: EPA's Office of Pesticide Programs

that may be posed by some of the thousands of commercial chemicals that are not regulated as either drugs, food additives, cosmetics, or pesticides.

SOURCES OF THE PROBLEM AND EPA'S APPROACH

With sales of over $182 billion per year, the chemical industry consists of over 12,000 firms employing over one million people. Many of the chemical industry's products are derived from oil or natural gas. These substances are often termed petrochemicals and, except for the nitrogen or ammonia derived from natural gas, they are organic compounds. The remainder of the industry produces inorganic chemicals such as chlorine and soda ash; industrial gases such as oxygen, nitrogen, and helium; and a variety of miscellaneous chemicals. Other industries that are major sources of toxic substances include those involved in metal and mineral processing.

Commercial Chemical Substances

TSCA gives EPA authority to control the risks from the 60,000 commercial chemical substances currently in commerce. For *new* commercial chemicals, EPA requires a manufacturer to submit a "premanufacture notice" that contains the chemical's name, structure, production process, intended uses, and other available information about the health and environmental effects of the chemical. EPA may prohibit or limit the production and use of a new chemical if it presents an unreasonable risk to health or the environment. EPA has similar authority to review and control significant new uses of existing chemicals or chemicals newly imported into the United States.

For *existing* commercial chemicals, TSCA gives EPA the authority to regulate the manufacture, processing, distribution, use, and disposal if there are unreasonable public health or environmental risks. Regulatory tools range from labelling and use restrictions to outright bans on their manufacture.

TSCA also authorizes EPA to require that industry test a chemical when there is insufficient data to assess the risks and there is likely to be substantial exposure. EPA also may require industry to maintain records of allegations of significant adverse reactions by workers and to report new information that suggests there may be substantial risks associated with the substance.

Pesticides

About 3.5 billion pounds of formulated pesticide products (1.2 billion pounds of active ingredients) are used in the United States each year. As might be expected, farmers are the biggest users of pesticides, accounting for about two-thirds of all pesticides used (Figure T-2).

As a class, pesticides are at the same time among the most beneficial and the most hazardous of substances. Farmers depend upon pesticide products to protect crops from insects, mildew, plant disease, and other pests. Health officials need them to combat the spread of diseases carried by mosquitos and other insects. On the other hand, because

Chemical products are now an accepted part of everyday life.

pesticides are designed to kill living organisms, unintended exposure to them can be very hazardous if sufficiently high. Because most pesticides are used on human or animal food crops, human dietary exposure is often unavoidable.

Under FIFRA, EPA has authority to control the risks of pesticides primarily through a registration process. All proposed uses of a pesticide must first be approved by EPA. This process involves a comprehensive review of potential health and environmental risks. The approved uses of a pesticide must be clearly indicated on the product's label. EPA has the power to initiate civil or criminal proceedings against any violation of the directions on the pesticide's label. EPA may also restrict or cancel some uses of an existing registered pesticide or completely remove the product from the market if it is found to pose unreasonable risks. Finally, EPA has authority to establish the maximum acceptable levels of pesticide residues in foods and animal feed, called "tolerance levels," that will protect human health while allowing for the production of an "adequate, wholesome and economic food supply."

PROGRESS TO DATE

Commercial Chemical Substances

Since the enactment of TSCA, EPA has screened more than 3,300 *new commercial chemicals.* The majority of these chemicals were found to present no unreasonable risk to human health or the environment. As a result of these reviews, however, EPA has prohibited or restricted the manufacture of 37 new commercial chemicals pending the development of additional test data. EPA has also extended the 90-day time limit for the review of numerous other new chemicals to allow for more thorough reviews or to give the applicants an opportunity to submit additional information. As a result of these actions, 61 new chemicals have completed or are now undergoing extensive health and environmental testing.

After several years' experience in new chemical review and regulation, EPA can now act more quickly to identify potential problems. EPA's risk assessments now screen chemicals for cancer, genetic mutation, birth defects, damage to the nervous or immune system, and reproductive failures as well as adverse environmental impacts.

We have chronic health effects and environmental data for only a small fraction of the chemicals in commerce. Identifying which among the thousands of *existing commercial chemicals* to test is a very important first step in managing risks from these chemicals. By March 1984, EPA had decided to request additional health and environmental testing by the manufacturers of 46 chemical groups. In addition EPA has reviewed, or is currently reviewing, an additional 20 existing chemicals or chemical

EPA'S APPROACH TO SELECTING CHEMICALS FOR REVIEW

Because complete risk assessments can cost several million dollars, they can only be required for a small fraction of the over 60,000 chemicals in commerce. A challenge for EPA is to determine what the risks of chemicals are without excessive costs. To this end, EPA has developed a multi-faceted approach for selecting which of the thousands of new and existing commercial chemicals to scrutinize more closely. Such an approach includes:

- ***Broad-based exemptions.*** *Certain chemical classes have repeatedly been shown to pose little, if any, possible risk to human health or the environment. In the new chemical review program, broad-based exemptions are being considered for certain polymers, chemical intermediates that are manufactured and consumed only within the production plant, and a number of low-volume chemicals where exposures are expected to be minimal. These exemptions would allow EPA to focus on chemicals that are more likely to pose significant risks.*
- ***Use of structure-activity analysis.*** *One useful screening technique is to compare a chemical's structure with the structures of other chemicals whose effects are better known. Frequently, chemicals with similar structures behave in similar ways. Such a process requires considerable technological expertise which EPA has developed. Structure-activity analysis must also be coupled with other information. In particular, we need to know expected production rates and intended uses to determine likely exposure.*
- ***Development of risk lists.*** *Certain types of chemicals, routes of exposures, and uses of chemicals have repeatedly been found to pose potentially significant risks. EPA is developing a "risk list" of these categories. EPA intends to distribute the list to manufacturers and advise them to develop certain health and environmental data necessary to determine the safety of proposed new chemicals or new uses of existing chemicals that fall within one of these risk groups.*
- ***Environmental monitoring.*** *EPA is expanding its monitoring of human tissue samples to include a broad spectrum of chemical substances. This monitoring will provide "early warning" of hazardous levels of toxic substances in the environment.*

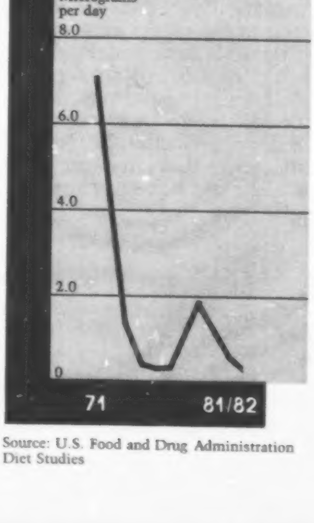


FIGURE T-3

PCB LEVELS IN FOOD HAVE GONE DOWN

Source: U.S. Food and Drug Administration Diet Studies

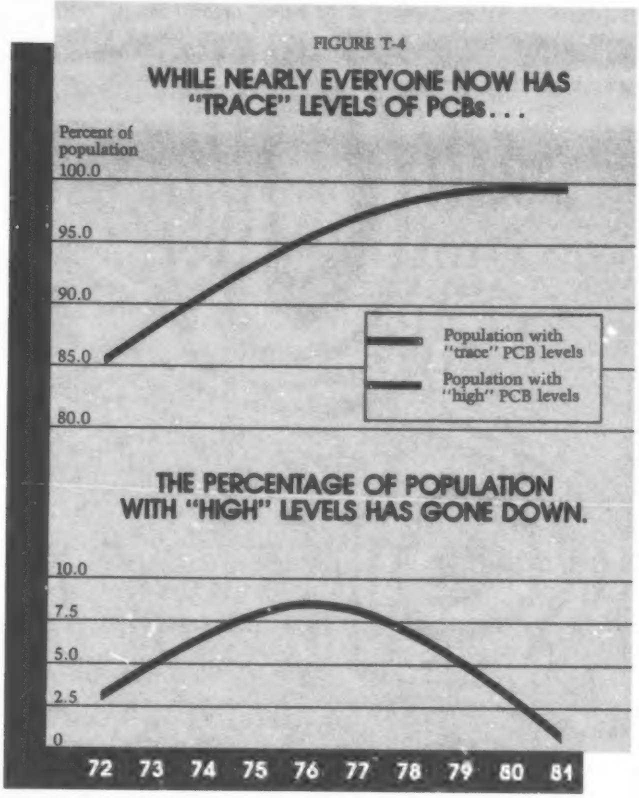


FIGURE T-4

WHILE NEARLY EVERYONE NOW HAS "TRACE" LEVELS OF PCBs . . .

THE PERCENTAGE OF POPULATION WITH "HIGH" LEVELS HAS GONE DOWN.

Source: EPA's Office of Toxic Substances

groups for possible regulatory controls. Examples of chemicals in the regulatory review process are:

- **MBOCA.** A curing agent used in plastics manufacturing has been shown to be carcinogenic in several species of animals.
- **MDA.** A high-production chemical, used primarily as an intermediate in the manufacture of other chemicals, has been shown to have serious carcinogenic potential.
- **Two glycol ethers and their acetates.** Large-volume chemicals used primarily as solvents for protective coatings and as intermediates may cause birth defects and liver and kidney damage.
- **1,3-butadiene.** A large-volume commodity chemical, used primarily in the production of synthetic rubber and resins, is an animal carcinogen.
- **TDA.** A large-volume chemical used primarily in the manufacture of polyurethanes (plastics) has been found to be carcinogenic in animal studies.
- **Epichlorohydrin.** A large-volume chemical, used as an intermediate to produce glycerin and epoxy resins, has been found to be carcinogenic in animal studies.

Earlier actions taken under TSCA have already begun to show results. For example, restrictions on the use and disposal of polychlorinated biphenyls (PCBs) has resulted in a significant decline of these residues in the environment, food (Figure T-3) and human tissues (Figure T-4). While trace levels (less than three parts per million) of PCBs are now almost

COATINGS, THE QUIET ENVIRONMENTAL SUCCESS

Traditionally, coating films could only solidify when their carrier solvents evaporated. In the atmosphere, these evaporated solvents could present direct health hazards or be converted to ozone. As a result of environmental regulation and energy considerations, industry has developed new coatings that require much less solvent and have significantly reduced air pollution emissions.

Before 1976, manufacturers used high solvent coatings although there were some exceptions. Several automobile companies had been using water-based prime coatings because of their superior corrosion resistance. Since 1976, however, there has been a major decrease in the use of high solvent coatings. This was particularly in response to increasing regulation under the Clean Air Act. The other reasons for this switch included: (1) lower fuel requirements because air flows in the curing ovens and workplace are no longer limited by solvent concentration; (2) reduced shipping costs since more material can be painted with the same volume of coatings; (3) lower fire insurance premiums; (4) reduced coating requirements as more efficient application techniques are implemented; and (5) reduced solid waste and water pollution problems. These low solvent or water-based coatings are also favored by consumers because they do not drip easily and brushes and rollers clean readily with water.

Today, much of the coating solvents have been replaced with water. A conservative estimate is that over half of the coating demand has been converted to low solvent type coatings, resulting in a savings of a million tons a year of solvent. The need for oil has been reduced by more than five-and-a-half million barrels annually. Since solvents used in surface coatings account for as much as 15 percent of the volatile organic compound emissions in some urban areas, the environmental benefit has been tremendous.

In summary, as coating manufacturers develop new low solvent coatings for industry, atmospheric contamination is abating. Energy requirements are decreasing. Solid waste problems are declining and transportation and storage costs are being reduced. An additional significant benefit is decreased dependence on oil. Environmental regulation can produce positive economic as well as environmental benefits.

uniformly present in the U.S. population, the number of individuals with high PCB levels (greater than three parts per million) has declined dramatically to less than one percent of the population.

Similarly, prior to EPA's 1978 ban on the use of chlorofluorocarbons (CFC) in aerosol sprays, estimates of ozone depletion in the upper atmosphere were as high as 18.6 percent. At that rate, the increase in ultraviolet light reaching the earth's surface would raise the incidence of skin cancers and have substantial impacts on crop production. Since CFC production dropped to approximately half of what it was before 1980, estimates of the amounts of ozone depletion were revised considerably downward to between five and nine percent. A better understanding of stratospheric chemistry has further revised that estimate to between two and four percent based on 1980 production levels.

Pesticides

EPA has cancelled some or all uses of a number of pesticides such as DDT, aldrin, dieldrin, toxaphene, and ethylene dibromide (EDB) because of both their toxicity and persistence (Figure T-5). These compounds generally do not break down in the environment but accumulate in the tissue of living organisms, including people who consume food containing pesticides. Figure T-6 shows the trends of

Aerial spraying of a pesticide

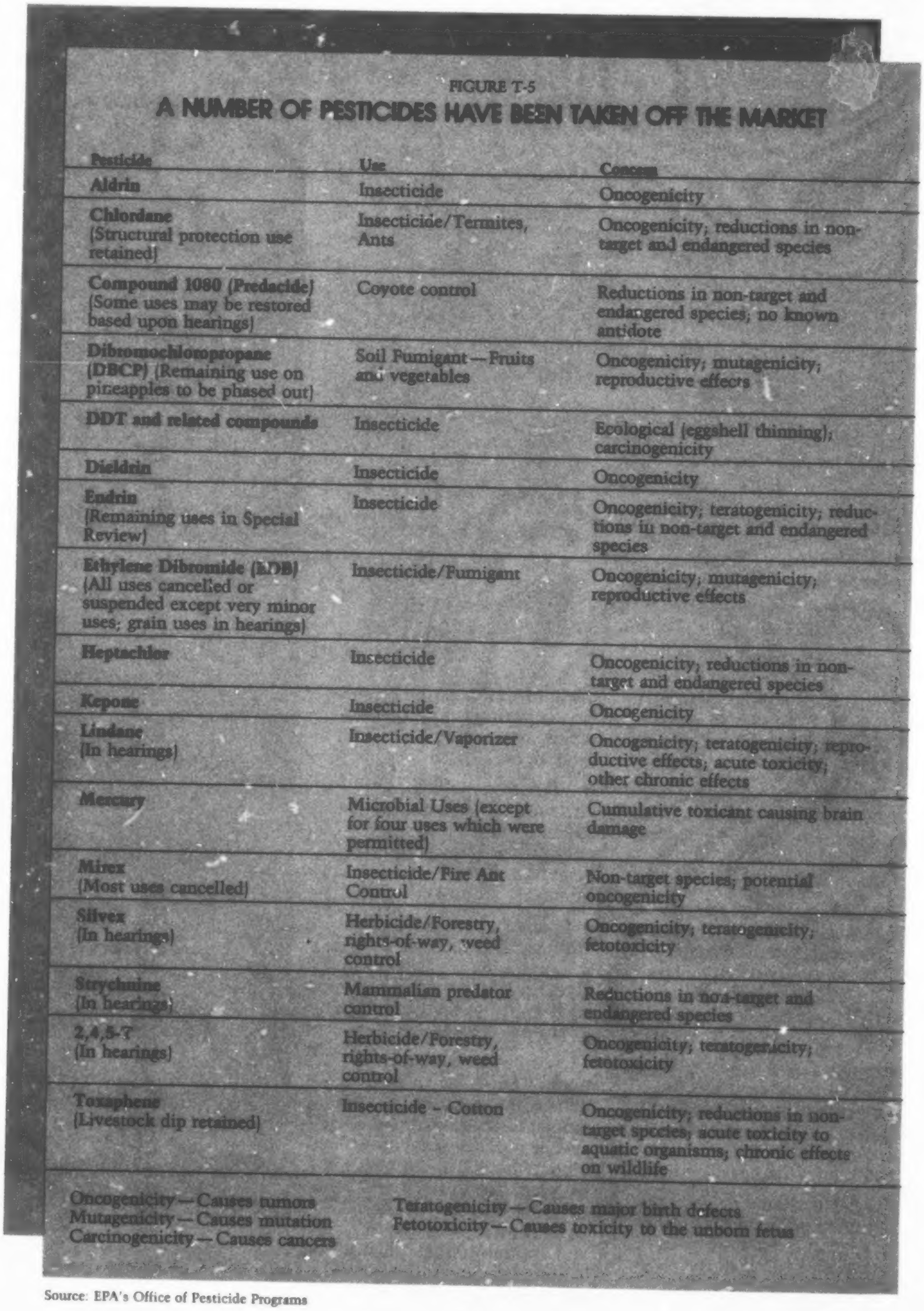


FIGURE T-5

A NUMBER OF PESTICIDES HAVE BEEN TAKEN OFF THE MARKET

Pesticide	Use	Concern
Aldrin	Insecticide	Oncogenicity
Chlordane (Structural protection use retained)	Insecticide/Termites, Ants	Oncogenicity; reductions in non-target and endangered species
Compound 1080 (Predacide) (Some uses may be restored based upon hearings)	Coyote control	Reductions in non-target and endangered species; no known antidote
Dibromochloropropane (DBCP) (Remaining use on pineapples to be phased out)	Soil Fumigant—Fruits and vegetables	Oncogenicity; mutagenicity; reproductive effects
DDT and related compounds	Insecticide	Ecological (eggshell thinning); carcinogenicity
Dieldrin	Insecticide	Oncogenicity
Endrin (Remaining uses in Special Review)	Insecticide	Oncogenicity; teratogenicity; reductions in non-target and endangered species
Ethylene Dibromide (EDB) (All uses cancelled or suspended except very minor uses; grain uses in hearings)	Insecticide/Fumigant	Oncogenicity; mutagenicity; reproductive effects
Heptachlor	Insecticide	Oncogenicity; reductions in non-target and endangered species
Kepone	Insecticide	Oncogenicity
Lindane (In hearings)	Insecticide/Vaporizer	Oncogenicity; teratogenicity; reproductive effects; acute toxicity; other chronic effects
Mercury	Microbial Uses (except for four uses which were permitted)	Cumulative toxicant causing brain damage
Mirex (Most uses cancelled)	Insecticide/Fire Ant Control	Non-target species; potential oncogenicity
Silvex (In hearings)	Herbicide/Forestry, rights-of-way, weed control	Oncogenicity; teratogenicity; fetotoxicity
Strychnine (In hearings)	Mammalian predator control	Reductions in non-target and endangered species
2,4,5-T (In hearings)	Herbicide/Forestry, rights-of-way, weed control	Oncogenicity; teratogenicity; fetotoxicity
Toxaphene (Livestock dip retained)	Insecticide - Cotton	Oncogenicity; reductions in non-target species; acute toxicity to aquatic organisms; chronic effects on wildlife

Oncogenicity—Causes tumors
Mutagenicity—Causes mutation
Carcinogenicity—Causes cancers
Teratogenicity—Causes major birth defects
Fetotoxicity—Causes toxicity to the unborn fetus

Source: EPA's Office of Pesticide Programs these pesticides in fish and birds in the United States. As a result of the banning of DDT and dieldrin there has been dramatic resurgence of birds that had been threatened by extinction. As illustrated in Figures T-8 and T-9, the levels of these pesticides in food have also significantly declined. The levels of pesticides in people have also either diminished or are soon expected to do so in a pattern similar to that of DDT (Figure T-7).

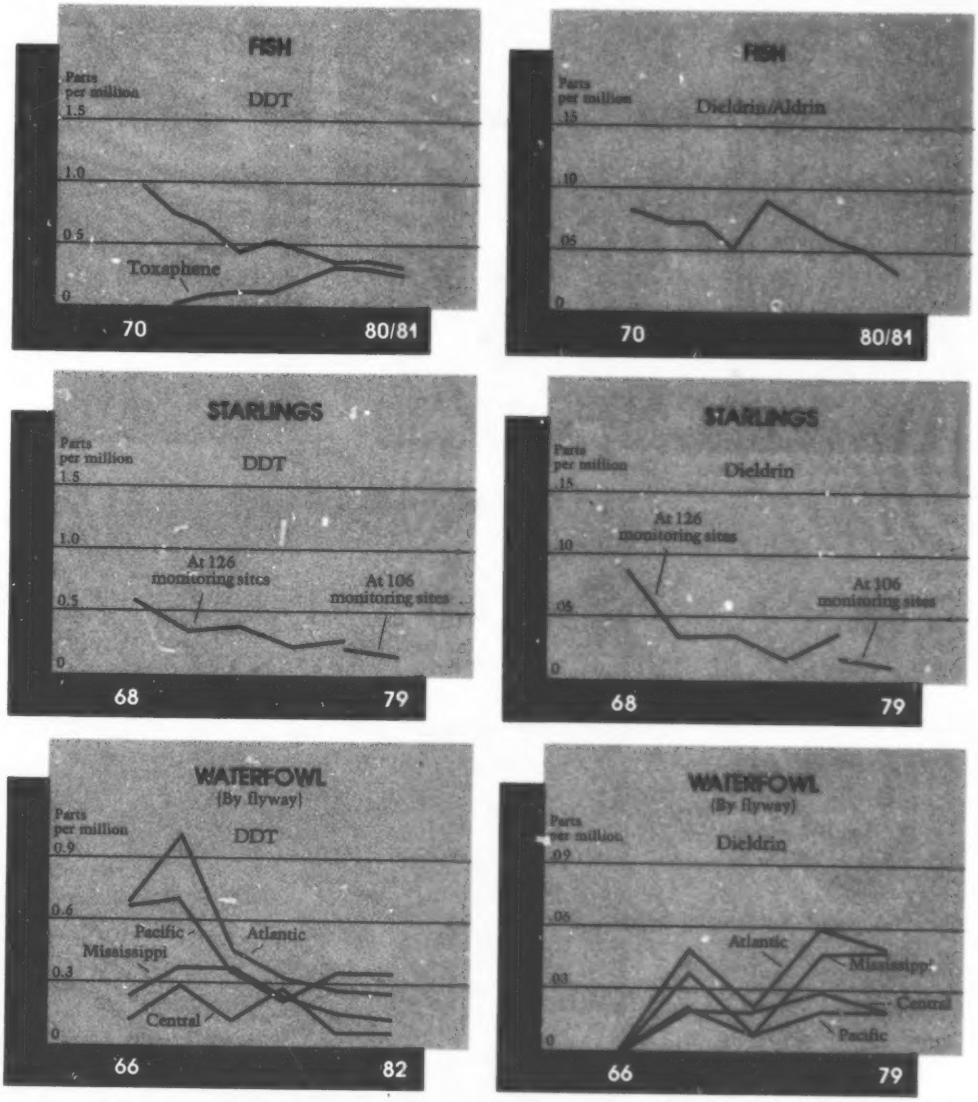
TODAY'S TOXIC SUBSTANCES CONTROL CHALLENGES

The following sections of this report present some of the major challenges EPA faces today in managing risks from pesticides and other commercial chemicals. Briefly, these challenges are:

- **Reducing unreasonable risks from pesticides.** EPA's continuing challenge is to identify and reduce unreasonable risks posed by pesticides. The contamination of ground water by pesticides has recently emerged as a major environmental threat.
- **Controlling critical toxic substances.** Dioxin, asbestos, and polychlorinated biphenyls are examples of the challenges that EPA faces in controlling the risks of chemical substances that are highly toxic and have become widespread in our environment. EPA must use all of its authority and work closely with other agencies to address the risks these substances present.

FIGURE T-6

EPA ACTIONS HAVE RESULTED IN DECLINING PESTICIDE LEVELS



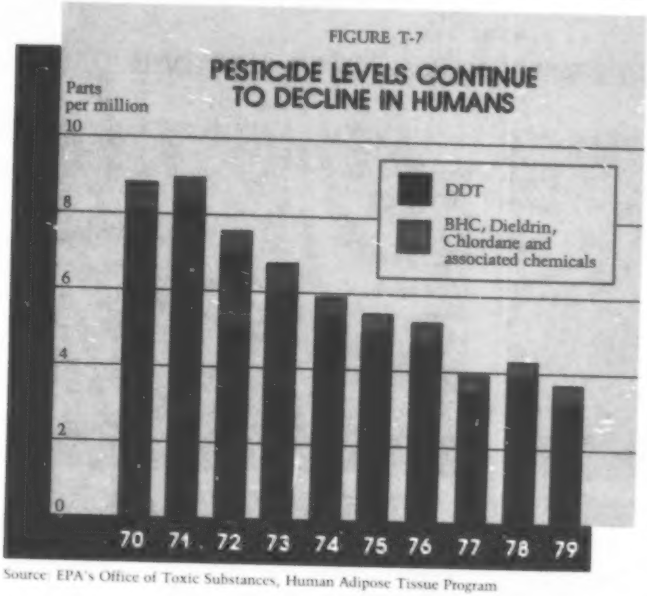
Source: U.S. Fish and Wildlife Service

Pacific
Central
Mississippi
Atlantic

WATERFOWL FLYWAYS

FIGURE T-7

PESTICIDE LEVELS CONTINUE TO DECLINE IN HUMANS



Source: EPA's Office of Toxic Substances, Human Adipose Tissue Program

DDT AND DIELDRIN LEVELS IN FOOD HAVE GONE DOWN

FIGURE T-8

DDT

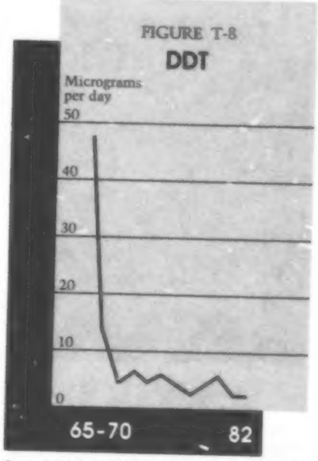
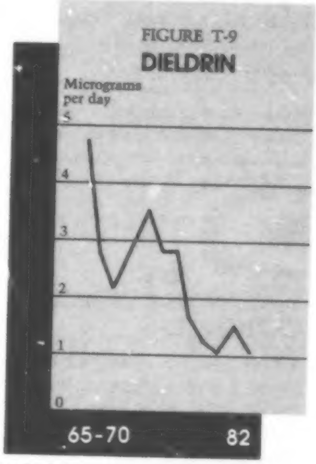


FIGURE T-9

DIELDRIN



Source: U.S. Food and Drug Administration Dietary Studies

PESTICIDE DECLINES SAVE ENDANGERED BIRDS

By the late 1960's field biologists had confirmed dramatic and continued declines in the population of several major species of birds. Strong evidence was accumulating that these declines were due, in large part, to the use of DDT and other persistent pesticides. Those birds threatened included the osprey, the peregrine falcon, the California brown pelican, and the national symbol, the bald eagle. They had all but vanished from many areas of their natural ranges.

Too few offspring of these birds were hatching successfully, causing the populations to decline steadily. Persistent pesticides and their byproducts had affected the calcium metabolism of these birds, making their eggshells so thin that they broke under the weight of the nesting birds. Research performed by the U.S. Fish and Wildlife Service revealed that the species most seriously affected by DDT were those that preyed on fish and small mammals exposed to the pesticides.

The plight of the California brown pelican provides an example of the impact of persistent pesticides on these birds. Its decline was mainly caused by DDT and its byproducts from major agricultural areas as well as discharges from the Los Angeles sewage treatment plant which received large amounts of wastewater from a DDT-manufacturing plant. Discharges from the manufacturing plant in 1971 alone resulted in the direct release of an estimated 10,000 pounds of DDT into the Pacific Ocean.

DDT contaminated many species in the Pacific Ocean's food chain along the California coast including the northern anchovy, the pelican's primary food. The effects of the DDT were dramatic. In 1969, only four pelicans were hatched in all of Southern California where they were once plentiful. In 1970, only one pelican was fledged on Annacapa Island from 552 mated pairs of birds. The California brown pelican became an endangered species.

Under pressure from EPA and the Los Angeles Sanitary District, the DDT manufacturer stopped piping its contaminated wastewater into the treatment plant. Instead, it began shipping the wastes to a sanitary landfill designed to handle hazardous materials. This action, along with the 1972 ban on most uses of DDT in the United States, resulted in an eventual decline in DDT levels in the coastal waters, and the California brown pelican has come back. Its resurgence has been so strong that some scientists no longer consider it an endangered species.

EPA'S PILOT "BIRTHWEIGHT" PROGRAM

To determine the degree of hazard from toxic chemicals in a particular locality, it is necessary to observe health effects on those who have been, or are likely to have been, exposed to the toxic substances. Yet the principal health impacts of a given toxic chemical are often effects like cancer or genetic damage, which may take many years to become evident. This makes it very difficult to identify and determine with certainty if an exposure to a toxic chemical results in an adverse health effect. One problem is that people often move away from an area where they were exposed to a cancer-causing chemical. Should a cancer develop some years later, it would be very difficult to trace back to its cause. Another problem is that when a normal incidence of a cancer or other health effect is something like 5 per 100,000 people, a tripling of the disease rate could only be visible in a relatively large population. Even an affected population of tens or hundreds of thousands of people may not be large enough for such health effects to show up statistically.

To overcome some of these problems, EPA scientists and State and local health officials have been considering other possible indicators of chronic toxicity. One indicator now under consideration is low birthweight. Normally, an average 6 percent of white children in the United States and 12 to 14 percent of black children have low birthweight (i.e., they weigh between 2.5 and 5.5 pounds). However, since fetuses are highly sensitive to the exposure of the mother to many toxic chemicals, the mother's exposure can result in a child with a lower-than-expected birthweight. For this reason these scientists believe that an increase in the number of children with low birthweight is grounds for suspecting the possible presence of toxic agents in the local environment.

EPA is now working with the States of New York and Missouri to pilot test the use of birthweight statistics as a screening technique for determining those areas that are possible toxic "hot spots." The Center for Disease Control (CDC), the National Institutes of Health (NIH), and the National Center for Health Statistics (NCHS), all in the U.S. Department of Health and Human Services, have shown strong interest in and support for this pilot effort.

The pilot work is well under way. The preliminary results indicate that the technique has great potential. Some apparent "hot spots" have already been identified. At the same time, EPA and the two pilot States have confirmed that use of the basic birthweight statistics alone can be misleading. There are a number of factors other than the presence of toxic chemicals that increase the percentage of newborn children with low birthweight. Among these other "risk factors" are cigarette smoking by the mother, the mother's age, family income, and the extent of prenatal care. It is therefore necessary to conduct a careful analysis of the available birthweight statistics that takes account of available information on these other risk factors.

When adjustments are made for these and other factors, a certain "rate" of unexplained low birthweights occurs. This is compared to the normal rate for the United States as a whole as determined by a one-percent sample of the U.S. birth records. Counties with a higher than average rate of low birthweight are then identified and targeted for further analysis. The pilot effort shows that a larger number of counties fall into this category than would occur by chance. There is also significant geographic clustering of these counties. The identified counties are then compared with areas contaminated with known pollutants to see if the excess low birthweight correlates with the time and location of exposure to specific toxic pollutants.

The pilot effort has also confirmed that use of birthweight statistics could be a remarkably inexpensive approach for identifying areas where public health may be adversely affected by toxic chemicals. Studies of cancer or birth defects normally require major new data collection efforts, which are both expensive and time-consuming. Birthweight studies make use of normal birth statistics, which are already available for every county in the United States.

Based on the results of the pilot effort to date, birthweight statistics show the potential for being a useful indicator of pollution-related health effects. It may prove valuable in showing where to look first for serious environmental problems due to the presence of toxic chemicals. EPA and the States can then use the results to focus their attention where the potential harm from toxic chemicals is greatest.

TOXIC CHEMICALS

Pesticides

THE PROBLEM

Pesticides contribute significantly to improved crop yields and to public health by controlling a wide variety of pests. On the other hand, pesticides can adversely affect people and non-pest organisms. Each year, almost 3.5 billion pounds of pesticides are used in the United States. If not handled correctly, some pesticides can cause serious health problems, even death if spilled on the skin, inhaled, or otherwise misused. Some of the earlier pesticides also persist in the environment over long periods of time, moving up through the food chain — from plankton or insects to birds, fish, animals, and eventually to humans through food. Finally, some pesticides exhibit evidence of causing chronic health effects such as cancer or birth defects. In short, while pesticides were initially considered to be a sort of modern day miracle, they have now come to be viewed more circumspectly.

EFFORTS TO DATE

Under FIFRA, EPA registers or licenses all pesticide products. EPA must approve any use of a pesticide, and manufacturers must clearly state the conditions of that use on the pesticide label. Under this program, pesticide package safety and label instructions and precautions have been improved substantially. Use of especially hazardous pesticides is restricted to certified applicators. Allowable limits of pesticide residues in food are set by EPA in cooperation with the U.S. Food and Drug Administration. When particular pesticides present unreasonable risks, EPA may undertake a variety of actions including immediate temporary suspension, permanent cancellation, or restriction of some or all uses.

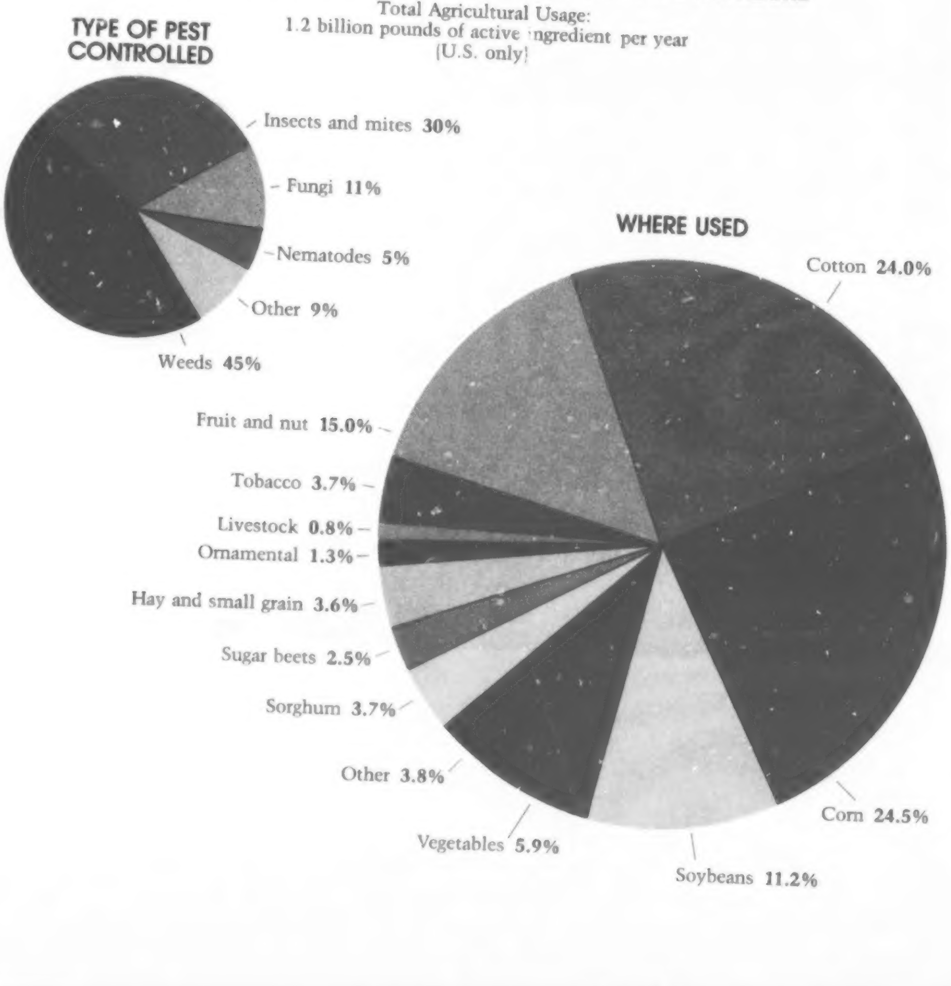
EPA conducts research on potential health and environmental effects of pesticides and on ways to use them that minimize unintended exposures in the environment. EPA also has sponsored research in the area of Integrated Pest Management to achieve equal or greater pest control using less pesticide.

Under FIFRA, the States have primary responsibility for enforcing pesticide use regulations. States may also establish EPA-approved pesticide certification and training programs. Individual States have also taken independent action to restrict certain pesticides. Some have more stringent controls governing pesticides than Federal programs.

FIGURE T-10

PESTICIDE USE PLAYS A MAJOR ROLE IN AGRICULTURE

Total Agricultural Usage:
1.2 billion pounds of active ingredient per year
(U.S. only)



TODAY'S CHALLENGES

EPA faces many challenges in protecting human health and the environment from unreasonable risks of pesticides. The following are some of the most significant of these challenges.

Re-Register Pesticides

Over 50,000 pesticide products have been registered since the program began in 1947. Most pesticide products were registered before we fully understood the long-term health and environmental effects of these chemicals and must be re-registered with these effects and others, such as potential for contaminating ground water, in mind. This task is complicated by the need to ensure reliable registration data. In the past, several cases have occurred in which invalid or misleading data have been submitted.

Avoid Abuse of Emergency Exemptions

Emergency exemptions may be granted to State or Federal agencies, authorizing pesticides to be used for purposes not yet registered. Emergency situations must meet the following requirements: (1) there is no registered pesticide or alternative method to control a pest outbreak; (2) significant economic or health problems will occur without the use of the pesticide; and (3) the time available is insufficient for a pesticide to be registered for that particular use.

An EPA audit of the Emergency Exemption program has led to concern of possible abuse or at least overuse. Since the uses involved have generally not undergone as extensive a risk assessment as is normally required for registration, Emergency Exemptions should only be authorized for genuine emergency situations.

FIGURE T-11

PESTICIDES ARE A MAJOR U.S. INDUSTRY

(1982 Market Estimates)

Production

- 30 major and 100 other producers of active ingredients
- 1400 registered active ingredients (derived from about 300 basic pesticide chemicals)
- 15 new active ingredients each year
- 1.5 billion pounds of active ingredients produced in U.S. with 0.4 billion pounds exported overseas

Marketing

- 1.2 billion pounds of *active ingredients* sold including 0.1 billion pounds imported
- 3,300 formulators and 29,000 distributors
- 50,000 formulated products registered
- 3.5 billion pounds of formulated products

Users

- 2.4 million farms, 75 million households, 40,000 commercial applicator firms, and several million industry and government users
- 2,500 pest species (6,000 varieties including different life stages for some pests)
- $6.5 billion of pesticide products purchased—60 percent by agriculture, 25 percent by industry and government users, and 15 percent by households for home and garden use

Source: EPA's Office of Pesticide Programs

Stop the Misuse and Careless Application of Pesticides

The purpose of the registration process is to evaluate the risks from particular uses of a pesticide and limit the risks, where necessary. If a person uses a pesticide inappropriately, it may cause significant risks to public health and the environment. The large number of pesticide users makes enforcement of pesticide restrictions very difficult. A particular problem is how pesticides are applied. Failure to apply pesticides carefully, particularly from airplanes or helicopters, can result in damage to nontarget crops, contamination of streams, and direct exposure to man, domestic animals, and wildlife. Such pesticide drift has posed problems in all major crop-producing regions of the country.

Prevent Ground-Water Contamination

In some areas of the country, ground-water wells are contaminated with pesticides. Such contamination has often been a result of improper or excessive uses of pesticides. In some cases, it may have been caused by approved uses as well. Certain types of pesticides such as high-soluable, soil-applied pesticides are now known to have great potential to move downward through soil in areas where the soil is sandy or where irrigating is extensive.

Improve Environmental Information

For some time, there has been little coordinated effort to monitor long-term trends of pesticide contamination in the environment. The U.S. Fish and Wildlife Service does monitor for some pesticides in fish and birds while EPA monitors for pesticide in human tissues. USDA monitors for pesticide residues in meat and poultry. The U.S. Food and Drug Administration (FDA) performs residue analysis for all other food products. These and other State and local efforts are not well-coordinated. The lack of well-coordinated pesticide monitoring efforts makes it difficult to determine what the nature and extent of pesticide contamination of the environment is.

BIOTECHNOLOGIES: FUTURE PROMISE, FUTURE CONCERN

The use of biotechnologies to modify the genetic codes of organisms offers great promise to further scientific understanding of biological processes and will likely provide a wealth of valuable products in such fields as medicine, agriculture, chemical manufacturing, and pollution control. Nevertheless, release of genetically engineered organisms into the environment, either accidentally or intentionally during certain applications, may possibly result in adverse impacts on human health or the environment. EPA is assessing the need to provide oversight of some uses of biotechnologies under both FIFRA and TSCA.

Under FIFRA authority, EPA is already regulating microbial pesticides (e.g., viruses, bacteria, and fungi) which have not been genetically altered. In regulating these natural products, EPA assesses the organisms' abilities to reproduce, cause disease in man and other animals, and survive in the environment. With genetically engineered microbial pesticides, additional testing will probably be needed to determine the traits and stability of these organisms' genetic material. EPA is also considering more stringent oversight of any field-testing of genetically modified microbial pesticides. Currently, companies must notify EPA of their plans to field-test a pesticide, but only when the testing exceeds ten acres. For genetically altered organisms, EPA is considering requiring notification regardless of the size of the test plot.

TSCA was enacted by Congress to bridge gaps in environmental protection and may be the logical candidate to govern potential risks from non-pesticide biotechnology products. If such products should be regulated under TSCA, companies would have to provide EPA information on any health effects test data, proposed uses of the altered organisms, likely production volumes, potential worker exposures, and probable disposal practices.

EPA is currently working with the National Institute of Health (NIH) Recombinant DNA Advisory Committee and other scientists to help sort out the Agency's role in this rapidly emerging technology. A task force is being formed by EPA and other agencies to discuss the regulation of biotechnology and the risk assessments needed to evaluate the potential adverse effects of these microbes should they be released to the environment. EPA's intent is to get ahead of any possible environmental problems that may emerge from this rapidly developing technology.

EPA'S AGENDA

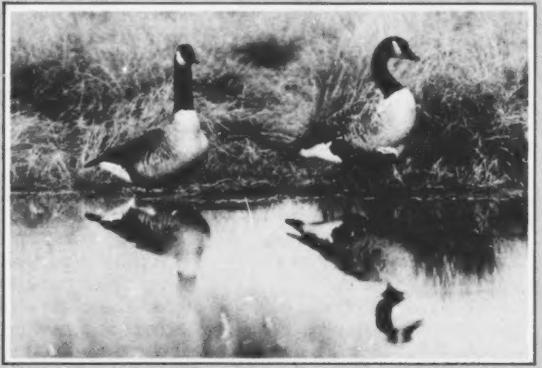
Expedite the Re-Registration of Existing Pesticides

EPA has established the Registration Standards Process to streamline the re-registration of existing pesticides. Instead of re-registering each of the thousands of pesticide products on a case-by-case basis, EPA is developing comprehensive standards for each of the 600 basic active ingredients used to formulate all pesticide products. Currently, EPA has set standards that cover 25 percent of existing pesticide products or 35 percent of the total tonnage of pesticides used in the United States. By the end of 1985, EPA plans to increase its coverage to about 52 percent of total U.S. pesticide tonnage by developing and applying standards for an additional 50 basic active ingredients in the next two years.

To assure validity of registration data, EPA and the U.S. Food and Drug Adminis-

DDT LEVELS FOUND TO BE RISING IN SOUTHWEST

DDT has been turning up in increasing concentrations in several western States. Officials in California and Texas, where elevated levels of the pesticide could threaten critical wildlife breeding grounds, believe that the fresh contamination is a result of American farmers using DDT purchased in Mexico, where it is still used legally. U.S. Fish and Wildlife Service (FWS) officials share that belief. EPA, however, is reviewing the pesticide dicofol, which is legally registered in the United States, as a possible source of this contamination problem.



According to a FWS study, the most critical area of DDT contamination appears to be the Arroyo Colorado watershed of western Texas, where fish and birds have residues within or above the range known to cause population declines. More importantly, the report finds the contaminated area empties into the Laguna Madre, one of the most extensive breeding and nursery grounds for fish and wildlife in the United States. The FWS study found DDT levels as high as 40 and 50 parts per million in some species. If concentrations had been declining at the expected rate, levels should be down to the one or two parts per million range. State health officials have been concerned enough to issue warnings about eating fish from the Arroyo Colorado area.

California officials have also documented unusual concentrations of the pesticide in fish and mussels from the Salinas River valley, south of San Francisco. Starlings tested in New Mexico and Arizona show increasing concentrations of DDT in their tissues, and additional "hot spots" have been identified in southern California.

Studies had shown that concentrations were dropping in almost all species across the United States until about five years ago, when the FWS's annual monitoring program turned up increases in migratory birds tested in the Trans-Pecos watershed of eastern New Mexico and western Texas.

This winter, the FWS launched another extensive study of contaminated areas. The draft results confirmed elevated levels in migratory birds, bats, insects, and fish. The FWS has discounted suggestions that DDT is drifting in from Mexico as a result of spraying there. FWS and State officials suspect DDT is being used illegally here in the United States on cotton.

EPA is investigating the possibility that dicofol, an increasingly popular pesticide, because of its effectiveness against a broad variety of aphids, mites, and other soft-bodied insects, may be causing much of the contamination. Dicofol can contain as much as seven percent or more of DDT as an unwanted by-product formed during the manufacturing process. EPA was not made aware of such contamination when dicofol was first registered, but the Agency is now reviewing the possiblity of cancelling some or all uses of this pesticide as a result of this information.

EPA will be working closely with the FWS and the States to find the source of this contamination.

ORTHO
Liquid SEVIN
ORTHO Malathion 50 Insect Spray
ORTHO Outdoor Insect Fogger
INSECT SPRAY
5.49
ISOTOX INSECT SPRAY
4.99

tration are conducting audits of testing facilities to determine if they are using sound laboratory practices and ensure that the data and reports submitted accurately reflect the test results.

Re-examine the Emergency Exemptions Program

EPA is planning to revise its regulations for emergency exemptions and is holding hearings across the country to solicit comments from the public prior to publishing any proposed changes. One possible option being discussed is to limit the period of time an exemption can remain in effect. EPA also will be examining the need for more stringent criteria for risk and economic loss information which must be shown to support a claim of emergency exemption.

Ensuring Proper Use and Application

EPA will continue to support State enforcement efforts with Federal funds and training of State enforcement personnel. EPA will also continue to provide funds to States for the certification and training of applicators. Enforcement efforts will focus on ensuring proper use of pesticides, particularly for cancelled or suspended products.

To address the pesticide drift problem, a spray drift task force has been established to assist States. The task force includes EPA, the U.S. Department of Agriculture, and the National Aeronautic and Space Administration along with State officials and industry representatives. EPA is exploring the usefulness of applicator training sessions including pre-season "fly-ins," which are used to demonstrate the latest methods and equipment for reducing drift problems.

Focus on Prevention of Ground-Water Contamination

EPA will focus its registration process on assessing the potential for pesticides to reach ground waters. EPA will publish guidelines advising registrants on how to develop data needed to predict the potential for pesticides to contaminate ground waters. EPA is also supporting the development of new scientific models for predicting the movement of pesticides in the soil into ground waters and is developing ground-water monitoring strategies. Finally, EPA will continue to publish health advisories for pesticides in drinking water to assist States in dealing with their ground-water problems. (See section on Ground-Water Protection.)

Implement a National Pesticides Monitoring Plan

A final plan for a National Pesticide Monitoring Program will be completed in 1984 and implemented beginning in 1985. The program will help assess the actual environmental results of pesticide regulatory policies, program, and actions. The effort will also help uncover any new environmental contamination problems. The plan will emphasize involvement of other Federal, State, and local agencies.

ETHYLENE DIBROMIDE

Ethylene dibromide (EDB) has been registered as a pesticide since 1948. Around 90 percent of this pesticide was used to fumigate soil to protect a number of crops (e.g., citrus, pineapples, soybeans, cotton, and tobacco) from nematodes (root worms). EDB is also used in quarantine programs to fumigate citrus and other fruits and vegetables after harvest to prevent the spread of tropical fruit flies and has been used to fumigate stored grain and grain-milling machinery to prevent insect infestation. Smaller uses of EDB have included termite control and the fumigation of storage vaults, beehives, and timber.

In 1977, when evidence confirmed that EDB could produce tumors, genetic mutations, and adverse reproductive effects in laboratory animals, EPA began a formal review of the pesticide's risks and benefits. During this review, EPA found evidence that significant levels of EDB residues could occur in food products as a result of grain and milling machinery fumigation. The Agency also recognized that the chemical properties of EDB indicated that it had the potential to contaminate ground water. Although there was no information that ground-water contamination had occurred, EPA arranged with the State of California to conduct ground-water monitoring to detect possible EDB contamination.

In December 1980, EPA decided to cancel EDB registrations for fumigating stored grain, milling machinery, and timber. However, as allowed by FIFRA, industry groups delayed final cancellation by formally appealing this action. EPA also decided to phase out, over a two-year period, the use of EDB in fruit and vegetable quarantine programs. Soil fumigation was retained, since this use did not appear to result in significant human exposure. Minor uses such as beehive and vault fumigation were also retained but with added safety precautions.

In June 1983, California's monitoring program found EDB contamination of ground water in areas where soil fumigation had occurred. A number of wells in Georgia, Hawaii, and Florida were also found to be contaminated. As a result of this discovery, EPA decided to take the strongest action the law provides, an immediate emergency suspension of the use of EDB for soil fumigation. More recently, findings of EDB residues in cereals and other grain products led EPA to also issue an immediate emergency suspension of the use of EDB for fumigating storage grain rather than wait for the outcome of industry's cancellation appeal.

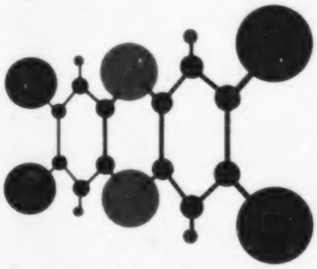
EPA's phase-out of the use of EDB to fumigate citrus and other fruits and vegetables for quarantine purposes is scheduled to be completed by September 1984. The phase-out will allow time for the development of economically feasible alternatives. Meanwhile, EPA has set a maximum safe level of 250 parts per billion of EDB on whole fruit or 30 parts per billion on edible portions. Also during the phase-out period, significant safety precautions for fumigation workers are being required, including the use of respirators and protective clothing.

Dioxin

THE PROBLEM

One of the most hazardous of all chemicals, dioxin (2,3,7,8-tetrachlorodibenzo-ϱ-dioxin or TCDD) can cause both acute and long-term effects ranging from chloracne, a skin disease, to cancer, reproductive failures, and reduced resistance to infectious disease.

Dioxin is an inadvertent contaminant produced in the manufacture of trichlorophenol (TCP), an herbicide and basic feedstock chemical used to produce the herbicides 2,4,5-T and silvex. Also contaminated with dioxin, these two pesticides were used until recently in agriculture, forest management, and lawn care. The herbicide 2,4,5-T was also an ingredient of Agent Orange, a defoliant used in Vietnam.



2,4,5,7-Tetrachlorodibenzo-ϱ-dioxin

DIOXIN

EFFORTS TO DATE

EPA has taken a number of regulatory actions to control dioxin contamination. In 1973, the Agency attempted to cancel the registration of the pesticide 2,4,5-T because of its dioxin contamination. This effort was not successful, partially because analytical chemistry techniques were not available at the time to measure dioxin at the extremely low levels found in food or the environment. In 1979, EPA placed an immediate suspension on the majority of 2,4,5-T and silvex uses, including their use in forests, rights-of-way, pastures, and home gardens. In 1980, under the Toxic Substances Control Act, EPA required that anyone handling dioxin-containing wastes notify EPA 60 days before moving or disposing of the wastes. Finally, in October 1983 the Agency proposed to cancel registration of all remaining uses of 2,4,5-T and silvex. Currently, EPA is not aware of any production of TCP, 2,4,5-T or Silvex in the United States.

FIGURE T-12

DIOXIN HISTORY: A QUICK GUIDE

1872 German scientists synthesize first chlorinated dioxins

1948 2,4,5-T registered as a pesticide with U.S. Department of Agriculture (USDA)

1957 2,4,5-T found to be contaminated with dioxin

1962 The use of 2,4,5-T begins in Vietnam as a defoliant including as an active ingredient in Agent Orange

1966 USDA establishes residue levels for 2,4,5-T in foods

1969 National Cancer Institute study shows 2,4,5-T containing dioxin is oncogenic

1970 USDA suspends 2,4,5-T uses that have likelihood of leading to high human exposures

EPA is formed and inherits FIFRA authority

1971 Lab studies find dioxin capable of causing a number of adverse chronic health and reproductive effects

EPA cancels 2,4,5-T use on most food crops

Stables in eastern Missouri are sprayed with dioxin-contaminated oil

1972 FDA bans use of hexachlorophene in nonprescription soaps and deodorants out of concern for possible dioxin contamination

Use of Agent Orange in Vietnam stops

1973 Vietnamese study links higher incidences of liver cancer, spontaneous abortions, and birth defects to Agent Orange spraying

EPA begins cancellation hearings for remaining uses of 2,4,5-T

1974 EPA stops cancellation hearings because analytical technology is insufficient to determine risks

EPA establishes Dioxin Implementation Program to improve analytical capabilities

1976 Chemical plant in Italy explodes spreading dioxin through densely populated area

1977 Dioxin Implementation Program develops an analytical method capable of measuring parts per trillion of dioxin

1978 EPA issues cancellation position paper for remaining uses of 2,4,5-T and silvex based on carcinogenicity and reproductive effects

Dioxin found in Tillabawassee River in Missouri

Dow study finds dioxin as possible combustion by-product from some municipal incinerators

1979 Study begins of association between 2,4,5-T spraying of forest and miscarriages in Alesa, Oregon

EPA issues emergency suspension of 2,4,5-T and silvex uses except on rangeland and rice fields

EPA study finds low dioxin contamination at PCB incinerator sites and around some municipal incinerators

First class action suits filed against chemical companies and U.S. government as a result of servicemen exposures to agent orange

1980 EPA cancellation hearings begun for both suspended and non-suspended uses of 2,4,5-T and silvex

EPA requires advance notice of disposal of dioxin-contaminated wastes

Dioxins found at various sites in Missouri

1981 Cancellation hearings suspended; settlement discussions begin

Office building is contaminated by dioxin as a result of fire involving PCB transformers

FDA advises people not to eat fish containing 50 parts per trillion dioxin

Class action suit brought against Veterans Administration and Department of Defense

1982 Extensive dioxin contamination is found at Times Beach and other Missouri sites

1983 EPA uses Superfund to relocate residents of Times Beach, Missouri

EPA develops Dioxin Strategy to determine extent of contamination in U.S.

TODAY'S CHALLENGES

While it appears that the major sources of dioxin (i.e., TCP production and the use of 2,4,5-T and silvex) are being eliminated, other potential and uncontrolled sources of dioxin have been identified. These include: (1) the production of other chlorinated chemicals similar to TCP; (2) fires involving electrical transformers containing polychlorinated biphenyls (PCBs); and (3) the burning of some municipal wastes that may contain significant amounts of either plastics made of polyvinyl chloride or wood preserved by certain chlorinated chemicals.

Moreover, the extent of dioxin contamination and associated health risks at sites where dioxin-containing products were produced, used, or disposed of remains uncertain. To date, EPA knows that at least the following places have some degree of contamination by dioxin:

- Thirty-three sites in Missouri;
- Tittabawassee River and Saginaw River and Bay, Michigan (Dow Chemical plant);
- Newark, New Jersey (Diamond Shamrock plant);
- Hyde Park Landfill, New York;
- Bayou Meto, Arkansas (Vertac plant, Jacksonville); and
- Sauget, Illinois (Clayton Chemical site).

The challenge for EPA is to identify and clean up sites that may pose significant risks from dioxin.

Times Beach, Missouri where dioxin contamination resulted in the abandonment of homes

EPA'S AGENDA

EPA is implementing a national strategy to determine the extent of dioxin contamination and, where necessary, limit further human exposure by isolating and cleaning up contaminated sites. In addition, EPA will identify disposal methods to alleviate current problems and develop regulatory measures to prevent future contamination.

EPA estimates that 80 to 90 percent of dioxin contamination will be found at TCP manufacturing, processing, and waste disposal sites. Cleanup activities at these areas will be managed under the Superfund program. Congress has provided special funds to address other dioxin-contaminated sites.

Dioxin research will be undertaken with other Federal agencies to learn more about its effects with different types and levels of exposure. EPA also has concern for the potential adverse effects of a number of chemicals that are very similar to TCDD in chemical structure. EPA will be investigating their presence in the environment and toxicity as part of the Agency's dioxin research effort. EPA is evaluating alternative ways to dispose of soils and wastes contaminated with dioxin such as solvent extraction of dioxin from soils and incineration.

In addition, EPA has initiated other regulatory activities, such as the addition of several industrial wastes that often contain dioxin to the list of hazardous wastes regulated under the Resource Conservation and Recovery Act.

FIGURE T-13

DIOXIN'S LETHAL DOSE VARIES GREATLY AMONG SPECIES

Animal	LD_{50} (micrograms per kg body weight)
Guinea pig	1
Rat (male)	22
Rat (female)	45
Monkey	<70
Rabbit	115
Mouse	114
Dog	>300
Bullfrog	>500
Hamster	5000

Source: Poland and Knutson, *Annual Review of Pharmacology and Toxicology*, 1982

FIGURE T-14

DIOXIN LETHALITY COMPARED TO OTHER POISONS

Substance	Animal	Minimum lethal dose (moles per kg body weight)
Botulinum toxin A	Mouse	3.3×10^{-17}
Tetanus toxin	Mouse	1.0×10^{-15}
Diphtheria toxin	Mouse	4.2×10^{-12}
2,3,7,8-TCDD	**Guinea pig**	**3.1×10^{-9}**
Bufotoxin	Cat	5.2×10^{-7}
Curare	Mouse	7.2×10^{-7}
Strychnine	Mouse	1.5×10^{-6}
Muscarin	Cat	5.2×10^{-6}
Dilsopropylfluorophosphate	Mouse	1.6×10^{-5}
Sodium cyanide	Mouse	2.0×10^{-4}

Source: EPA's Office of Toxic Substances

TOXIC CHEMICALS

Asbestos

THE PROBLEM

A strong and incombustible mineral fiber, asbestos has been widely used for fireproofing and insulating homes and other buildings. Some 800,000 tons of asbestos have been mined or processed in the United States each year to make about 3,000 different products, two-thirds of which have been used in the construction industry.

Once in the air, asbestos fibers, much smaller and more buoyant than ordinary dust particles, float almost indefinitely and can easily be inhaled or swallowed. Once the fibers enter the body, they can cause a number of serious diseases including:

- **Asbestosis.** A chronic disease of the lungs which makes breathing more and more difficult and can cause death.
- **Cancer.** Breathing asbestos fibers can cause lung cancer. Also, since some of the asbestos fibers are rejected by the lungs, move up to the throat, and are swallowed, breathing asbestos may also cause cancer of the esophagus, stomach, intestines, and rectum.
- **Mesothelioma.** A cancer of the membranes that line the chest and abdomen. Mesothelioma almost never occurs in people who have not been exposed to asbestos. It is always fatal.

Once asbestos gets into the body, it remains there indefinitely. It can move from the lungs to almost all other parts of the body. Cancers can occur anywhere from 15 to 40 years after the first exposure. No safe limit or "threshold" of exposure is known. Any exposure to asbestos carries some risk to health, and people exposed to low levels of asbestos for a very brief period have later contracted mesothelioma. Finally, anyone exposed to asbestos who also smokes cigarettes has five times the likelihood of contracting lung cancer than does a cigarette smoker who has not been exposed to asbestos.

RETIRED PERSONS INSPECTING SCHOOLS FOR ASBESTOS

A large number of schools built before EPA's 1978 asbestos ban contain this carcinogenic substance as insulating, fireproofing, or decorating material. To reduce the risk of school children being exposed to asbestos, EPA published regulations under the Toxics Substances Control Act (TSCA) that required school districts to perform inspections and to notify employees and parents if the substance was found. Schools were not required to remove the asbestos but were required to keep records of their sampling and notifications. EPA provided schools with an extensive technical assistance program to aid them in understanding the requirements and proper identification and removal techniques. Compliance with these regulations was required by May 1983.

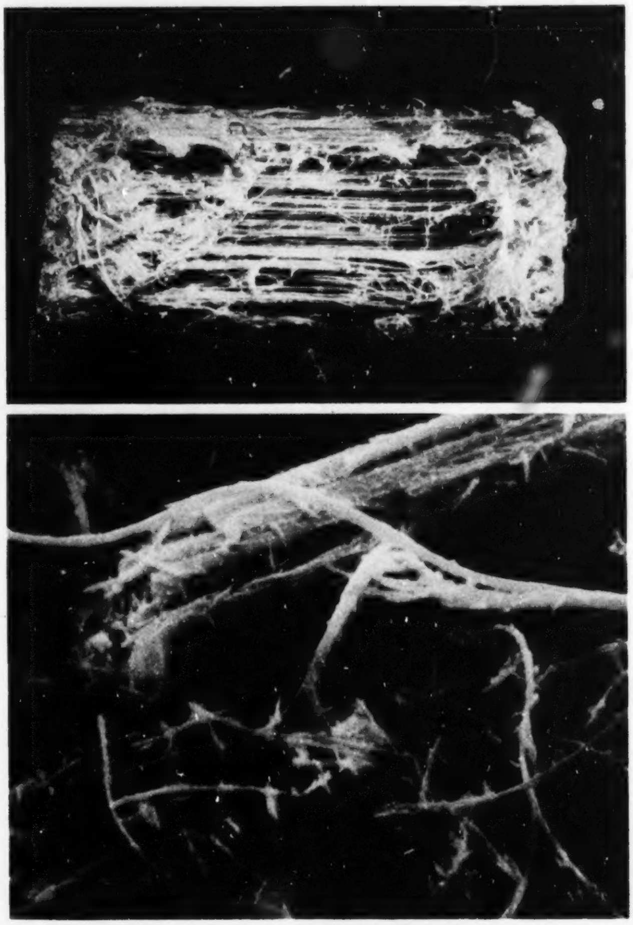
EPA has the authority to enforce these regulations. However, EPA's Regional offices have had difficulties in doing so as a result of the large number of school districts.

As an example, New England alone has over 130 school districts, many with several schools to a district, as well as several hundred parochial schools. EPA's Region 1 office, which is responsible for the New England area, did not have enough resources to inspect such a large number of school districts within a reasonable time period. The Regional enforcement staff felt that additional resources had to be found in order to ensure that school districts were complying with the regulations.

Region 1's solution to this problem occurred when the Region was able to allocate unspent funds to an existing grant with the American Association of Retired Persons. AARP, a national association, has a senior community service employment program that solicits funds from a number of sources and uses them to hire trained retired persons. Using this grant, Region 1 was able to hire AARP enrollees to work on asbestos enforcement.

The result has been an intensive enforcement effort that resulted in many hundreds of school employees and parents being made aware of the presence in their schools of over a half-million square feet of friable asbestos. The average cost to the Agency has been less than $150 per site inspected. These results could not have been achieved without the AARP inspectors. The succees of the program has been based on several factors, including the availability of an easily used funding mechanism, the ability to quickly train the inspectors in required procedures, and the enthusiasm and ability of the individual inspectors.

Region 1 is continuing the program by extending the grant beyond its original date. Other EPA Regional offices have now adopted similar programs or have them under consideration. The AARP story proves the potential value of an underused national resource, retired persons, in implementing a high priority public health program.



Top: Raw chrysotile asbestos. Bottom: Magnified asbestos fibers.

Asbestos was once considered a health risk only for asbestos workers. Now asbestos is known to be a potential hazard to the health of millions of people, on and off the job, who are routinely exposed to asbestos fibers in the air they breathe. Among those whose health may be endangered by asbestos are children, teachers, and others in schools where asbestos was sprayed or troweled on ceilings, rafters, beams, and other structural building parts for fire-proofing, insulation, sound-deadening, or decoration.

EFFORTS TO DATE

The Occupational Safety and Health Administration has established limits for worker exposure to asbestos on the job. The Food and Drug Administration is responsible for making sure that foods, drugs, and cosmetics are not contaminated with asbestos. The Consumer Products Safety Commission (CPSC) regulates asbestos in consumer products; it has already banned the use of asbestos in hair dryers, consumer clothing, ceramic logs in gas-fired fireplaces, and dry-wall patching compounds. CPSC is studying the extent of asbestos use in all consumer products and is considering banning all nonessential uses of asbestos in consumer products that can release asbestos fibers.

In addition to regulating air and water contamination by asbestos, EPA also prohibited the spraying of asbestos materials for fire-proofing and insulation in 1973, banned the use of asbestos that can crumble in pipe and boiler coverings in 1975, and prohibited virtually all uses of sprayed asbestos materials in 1978.

Of particular concern is the exposure of children to asbestos as a result of the use of this material for insulating and fire-proofing school buildings. Since children would be exposed early in their lives, asbestos-induced cancers would have plenty of time to develop. To safeguard the health of school children, EPA issued regulations under TSCA and launched a program to: (1) have schools inspect their buildings for asbestos; (2) maintain inspection records; and (3) inform employees and local PTAs when asbestos is found. EPA

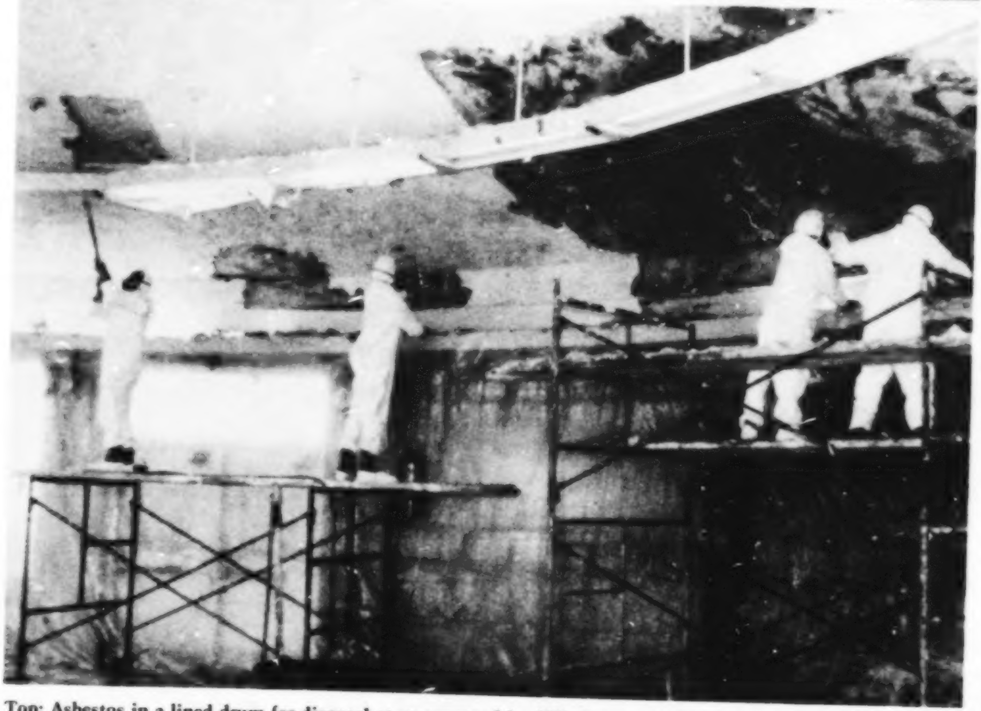
Damaged asbestos pipe insulation

is conducting a survey to see how many schools have complied with these requirements and what abatement activities have been undertaken.

EPA has prepared and made available to State and local governments and schools two manuals that explain, step-by-step, how asbestos problems can be identified and corrected. The Asbestos School Guidance Package and a videotape outlining the procedures explained in the manuals is available from EPA's Regional offices.

TODAY'S CHALLENGES

Recent compliance information indicates that many schools are not complying with EPA's regulations requiring them to inspect their buildings for asbestos problems. Furthermore, it is difficult to determine if corrective measures, when they have been taken, adequately reduce or prevent future exposure. Moreover, EPA has not yet addressed other sources of asbestos in commercial as well as other public buildings. EPA's challenge is to make sure that the hazards of asbestos are identified and promptly addressed to reduce exposures by the general population.



Top: Asbestos in a lined drum for disposal at an approved landfill. Bottom: Asbestos being removed.

EPA'S AGENDA

EPA is increasing its compliance monitoring efforts aimed at ensuring the inspection of school buildings for asbestos problems. Approximately 2,500 compliance inspections will be conducted during 1984 and 1985. EPA is also in the process of obtaining public comment on more stringent regulations of asbestos in schools. Such regulations would set acceptable levels of asbestos in schools which, if exceeded, would require specific corrective actions.

EPA is currently gathering information on the extent to which friable asbestos-containing materials are present in other public and commercial buildings. Through its technical assistance program, the Agency is also continuing to assist building owners in the detection and correction of hazards posed by asbestos.

FIGURE T-15

EPA REGIONAL ASBESTOS COORDINATORS

EPA Region I
Asbestos Coordinator
Air and Hazardous Material Division
JFK Federal Building
Boston, MA 02202
(617) 223-0585

EPA Region II
Asbestos Coordinator
Woodbridge Avenue
Edison, NJ 08837
(201) 321-6668

EPA Region III
Asbestos Coordinator
Curtis Building
6th and Walnut Street
Philadelphia, PA 19106
(215) 597-9859

EPA Region IV
Asbestos Coordinator
345 Cortland Street
Atlanta, GA 30365
(404) 881-3864

EPA Region V
Asbestos Coordinator
230 S. Dearborne Street
Chicago, IL 60604
(312) 886-6003

EPA Region VI
Asbestos Coordinator
First International Building
1219 Elm Street
Dallas, TX 75270
(214) 767-2734

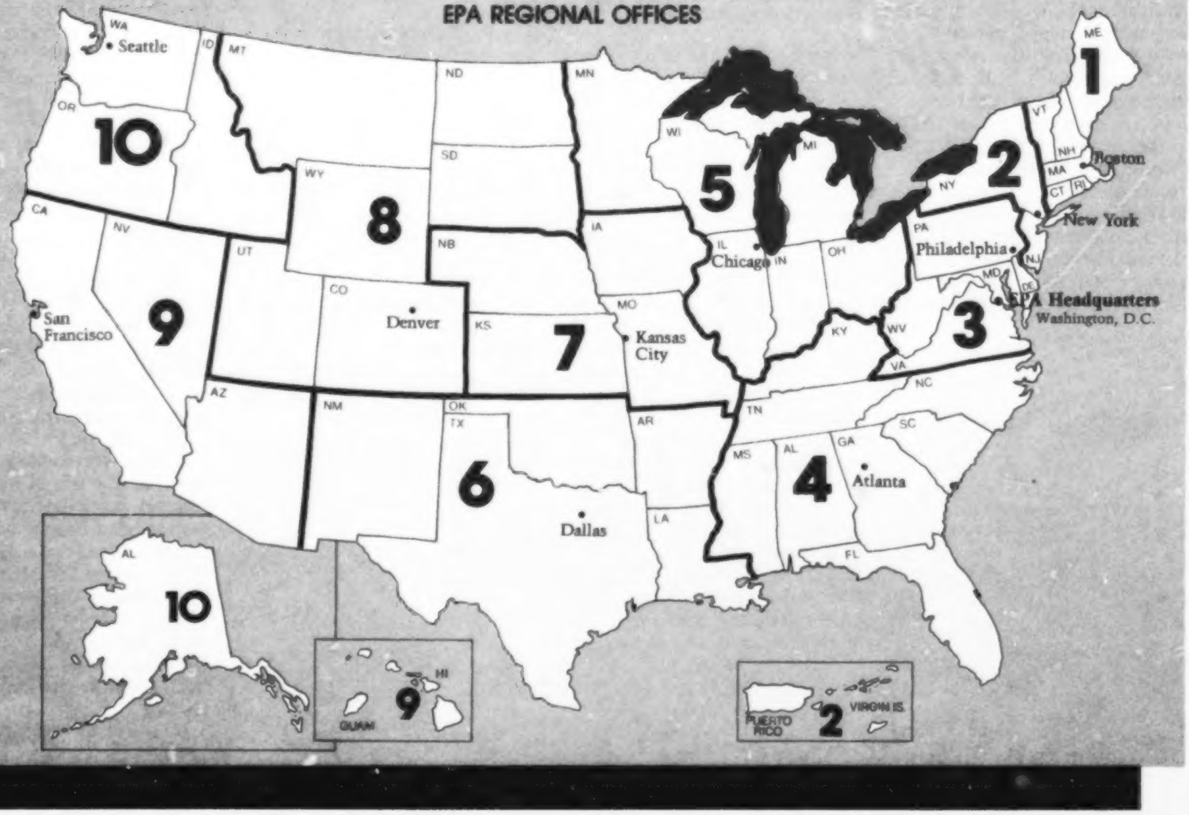
EPA Region VII
Asbestos Coordinator
324 E. 11th Street
Room 1411
Kansas City, MO 64106
(816) 374-6538

EPA Region VIII
Asbestos Coordinator
1860 Lincoln Street
Denver, CO 80295
(303) 837-3926

EPA Region IX
Asbestos Coordinator
215 Fremont Street
San Francisco, CA 94105
(415) 974-8123

EPA Region X
Asbestos Coordinator
1200 6th Avenue
Seattle, WA 98101
(206) 442-2632

EPA REGIONAL OFFICES

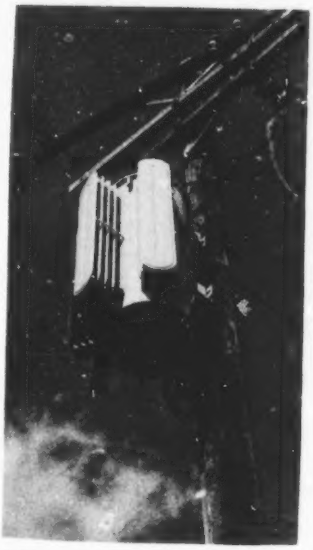

WA
Seattle
ID
MT
ND
MN
ME
1
OR
10
SD
WI
MI
VT
NH
Boston
MA
CT
RI
2
NY
5
WY
8
CA
NV
UT
NB
IA
IL
Chicago
IN
OH
PA
Philadelphia
NJ
New York
MD
DE
EPA Headquarters
Washington, D.C.
San Francisco
9
CO
Denver
KS
MO
Kansas City
7
KY
WV
3
VA
AZ
NM
OK
TX
AR
TN
NC
SC
6
Dallas
MS
AL
GA
4
Atlanta
LA
FL
AL
10
HI
9
GUAM
PUERTO RICO
2
VIRGIN IS.

PCBs

THE PROBLEM

Polychlorinated biphenyls, commonly called PCBs, were manufactured in the United States from 1929 to 1977. PCBs have characteristics that make them ideal for many commercial uses, especially as heat transfer fluids in electrical transformers and capacitors. PCBs have also been used as hydraulic fluids; as dye carriers in carbonless copy paper; and in paints, adhesives, and caulking compounds. Although manufacturing and importing of all but research quantities of PCBs stopped over a decade ago, EPA estimates there are over 750,000 pounds of PCBs still in use in transformers, capacitors, and other products.

PCBs are among the most stable chemicals known. Once they are released into the environment, PCBs decompose very slowly over a period of several decades. Plants and animals can absorb PCBs from their surroundings and concentrate these chemicals within their tissues to levels above those found in the environment. As living organisms containing PCBs are eaten by other organisms, the amount of PCBs consumed by each higher organism increases. The concentrations consumed by humans, at the end of the food chain, can be significant.



PCBs are still in use in thousands of electrical transformers.

In well-documented tests on laboratory animals, it has been shown that PCBs can cause reproductive disorders, birth defects, gastric disorders, skin lesions, swollen limbs, cancers, tumors, and eye and liver disorders, among other health problems. The dangers from relatively high exposures to PCBs were dramatically and tragically demonstrated in 1968, when some 1,300 people in Yusho, Japan, used rice oil that had been accidentally contaminated with PCBs leaking from a transformer. The victims developed a variety of ailments characterized as "Yusho Disease" including skin lesions, eye discharges, abdominal pain, and reproductive and nervous system disorders. There is also evidence of an increased rate of cancer among the Yusho victims who have died since 1968. As a result of the Yusho tragedy, the Japanese government virtually banned the production, import, or export of PCBs in 1972.

CAUTION
PCBs

PCB warning label on electrical equipment

PCB contamination has also been observed in the United States. Measurable amounts of PCBs can be found in soils, water, fish, milk, and human tissue. Some fish in the Hudson River, New Bedford Harbor, Great Lakes, and other water bodies have become too contaminated with PCBs for human consumption. In addition, there have been several major incidents of PCB contamination in food processing plants. For example, in Billings, Montana, PCBs leaking from a transformer at a packing company contaminated animal feed that was later distributed and used in several States.

EFFORTS TO DATE

Until 1976, EPA could only regulate discharges of PCBs into waterways. Through the enactment of TSCA in 1976, Congress directed EPA to prohibit the manufacture, processing, distribution and use of PCBs, except for totally enclosed uses. Congress also authorized EPA to require adequate labeling and safe disposal of the PCBs still in use. Under this authority, EPA has issued regulations prohibiting the manufacture and distribution of PCBs and limiting their use to totally enclosed electrical equipment. Where there are no unreasonable risks to health or the environment, EPA has allowed a few additional uses of PCBs until July 1, 1984. Some of these exceptions are currently being considered for extension. EPA requires weekly inspections of transformers and electromagnets with a PCB concentration of 500 parts per million or greater in food or feed operations and prohibits them altogether after October 1, 1985. EPA has also established strict regulations for the final disposal of PCBs in incinerators or chemical waste landfills.

With the banning of PCB manufacturing and strict limits on their use and disposal, the levels of PCBs in the environment are beginning to decline. In a number of areas, including the Great Lakes and the Hudson River, fish that were once too contaminated with PCBs for human consumption have recently been found to have much lower levels. While restrictions on fishing remain in a number of these areas, there is hope that levels will continue to decline and eventually these areas can be reopened to both commercial and sport fishing.

EPA surveys have also found a decline in the number of people with "high" levels (i.e., greater than three parts per million) of PCB in their tissues although "trace" levels (i.e., less than three parts per million) are now ubiquitous within the U.S. population.

TODAY'S CHALLENGES

Thousands of electrical transformers and capacitors containing PCBs remain in use throughout the United States. The challenge for EPA is to ensure that PCB-contaminated equipment and fluids are properly maintained and disposed of in accordance with the regulations under TSCA.

EPA'S AGENDA

Ensuring compliance with PCB regulations will receive additional emphasis by EPA. EPA's efforts will concentrate inspections and enforcement actions on the greatest potential sources of exposures to PCBs and those industrial sectors exhibiting unacceptably high violation rates such as transformer manufacturing facilities and scrap and salvage operations. Because the life of a transformer containing PCBs can be 20 to 30 years, EPA must maintain a vigilant enforcement effort for some time.

PCB TRACES FOUND IN HARBORS AND BAYS

The EPA-sponsored U.S. Mussel Watch Program collected and analyzed mussels and oysters from 106 stations along the Nation's Atlantic, Gulf and Pacific coastlines from 1976 to 1978. The soft tissues of these marine bivalves were analyzed for a variety of toxic substances including PCBs, pesticides, lead, plutonium, and petroleum contamination. Several "hot spots" of PCBs were identified including the mouth of New Bedford Harbor in Massachusetts, which has since been placed on the Superfund's National Priority List for cleaning up extensive PCB contamination.

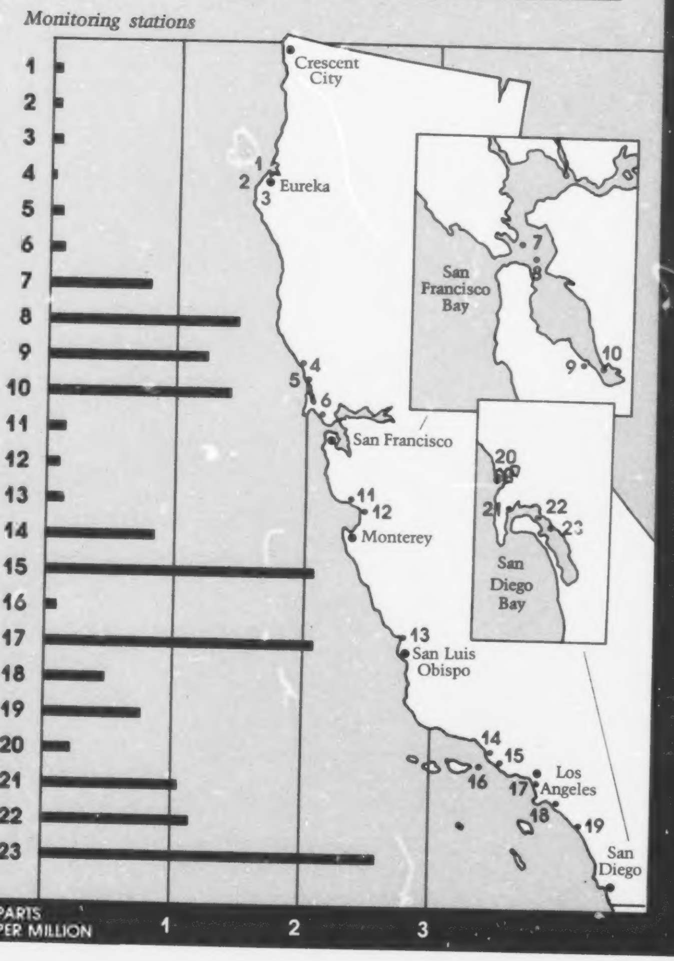
Also located were "high" PCB areas including some spots along the coast of California. As a result of concern for this contamination by PCBs and several other toxic substances, the State of California initiated its own mussel watch program with specimens collected in 1977.

The California Mussel Watch has recently found measurable levels of PCBs in the Los Angeles and Long Beach Harbors as well as in San Diego Bay and Newport Harbor. While the amounts found do not exceed Federal health standards, they show for the first time that levels there have come close to the five parts per million Federal standard.

The study found the most serious PCB problem in San Diego, where the level at one test site was discovered to be four parts per million. Here, the source appears to be an airport where PCB equipment was in heavy use.

Los Angeles Harbor had lower levels of PCBs than that of San Diego, but residues were found throughout the area. The major source in this harbor appears to be shipyards.

California is intensifying these monitoring studies to further pinpoint the sources of PCB contamination and determine if there is any threat to people or to the environment.



☆ U.S. GOVERNMENT PRINTING OFFICE : 1984 O - 444-729 :